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The relationship between coals and dispersed organic matter in associated sediments in four basins in central Australia

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The relationship between coals and dispersed organic matter in associated sediments in four basins in central Australia

by

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Statement of Originality.

I hereby certify that the work embodied in this thesis is the result of original research and has not been submitted for a higher degree to any other University or Institution.

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ABSTRACT

The major oil and gas fields in Australia produce from coal measure sediments, in contrast to the giant oil fields of the Northern Hemisphere which are associated with the marine rocks.

The organic matter in the Australian fields is present both as coal seams and fragments of coaly material dispersed through the adjacent sediments. The purpose of this study is to determine whether the organic matter in the coal seams and as dispersed fragments is the same, different or systematically related. The type of organic matter in each may indicate that one is better, or the same, as a source for hydrocarbons.

The sedimentary sequences examined are those of the Permian-Triassic Cooper Basin, the Permian Pedirka Basin, the Triassic Simpson Desert Basin, and the Jurassic-Cretaceous Eromanga Basin, all of which are located in central Australia.

In addition, the relationship of organic matter type to the depositional environment for the Permian sequence in the Cooper Basin was investigated.

All of the studies were carried out using reflected and transmitted light microscopic techniques for analyses of the organic matter.

Relationships have been found between the maceral types of the dispersed organic matter (DOM) and the maceral and microlithotype compositions of the associated coals.

Exinite (sporinite) DOM correlates with vitrinite and sporinite in the associated coals in the Cooper and Eromanga Basins. Exinite (cutinite) DOM correlates negatively with cutinite in the coal in the Simpson Desert Basin. Sporinite DOM correlates with vitrite plus

clarite and intermediate microlithotypes (duroclarite, clarodurite and vitrinertite) in the coals of the Cooper Basin.

Vitrinite DOM correlates with vitrinite and the intermediate microlithotypes in associated coal in the Cooper Basin, and with resinite in the coal of the Eromanga Basin. Inertinite DOM, mostly inertodetrinite, correlates with inertodetrinite and durite plus inertite in the associated coals in the Cooper Basin.

The microlithotype compositions of coals formed in association with a large lake environment are distinctly different from the microlithotype compositions of coals formed on the lower coastal plain and in areas dominated by coal swamps in the Permian of the Cooper Basin. Channel belt coals are also distinct in type from those of the lower coastal plain, upper coastal plain and areas dominated by coal swamps. Lower coastal plain coals can be differentiated from upper coastal plain coals on the basis of their microlithotype compositions.

Those coals with the highest vitrite plus clarite contents have formed in channel belts and associated with large lakes. Coals with the highest durite plus inertite contents have formed in the areas dominated by coal swamps.

Given that exinite is the coal maceral richest in hydrogen, and therefore the best material for generating hydrocarbons, the best source rocks in the Permian of the Cooper Basin are those which have formed in the large lake and channel belt environments. If inertinite has the least potential as a source for hydrocarbons, then the sequences in areas dominated by coal swamps have the lowest potential as source rocks for hydrocarbons.

1. INTRODUCTION

Organic matter occurs in sedimentary rocks in volumes which range from traces to 100%. The variation in organic matter content is gradational, with no sharp cut-off points in the series between, for example, carbonaceous shale and shaly coal. Rocks with a volume of more than 90% organic matter, such as coal seams, and those with less than 10% organic matter, such as carbonaceous shales, are the end member of this series. Coal and carbonaceous shale frequently occur together in sedimentary sequences.

In Australia, the major hydrocarbon producing basins all contain terrestrial sequences, including coal measures. The coals and carbonaceous shales are generally considered to be the sources for the hydrocarbons. The purpose of this study is to determine whether the organic matter in the coals and shales is the same, different or systematically related. The type of organic matter in each may show whether the potential of one is better than the other, or is the same as a source for hydrocarbons.

In addition, the usefulness of the organic compositions of the coals as indicators of sedimentary environments is to be examined. It is possible that the petrographic composition of coals could be used to reconstruct palaeoenvironments, thus helping delineate the optimum areas for source and reservoir rocks.

1. (i) Study areas

Significant variations in the type and quantity of organic matter in sedimentary rocks can occur due to its being of marine or terrestrial origin (Tissot and Welte, 1978). The Cooper Basin (Fig.1.1) which contains commercial gas and oil accumulations, has been chosen as the major area for investigating the organic matter in coals and associated sedimentary rocks, because the organic matter in the Permian and Triassic sequences of the Cooper Basin is substantially terrestrial in origin.

The Permian Pedirka and overlying Triassic Simpson Desert Basins to the west of the Cooper Basin are similar to it in tectonic setting (Fig.1.1). These basins have been selected as another area for study, as they also contain predominently terrestrial coal measure sediments.

The thick Mesozoic sequences of the Eromanga Basin (Fig.1.1) overlie the preceeding Permo-Triassic basins. Commercial oil and gas occur in the Eromanga Basin overlying the Cooper, and oil was found in the Jurassic sediments where the Eromanga Basin overlies the Simpson Desert Basin. The organic matter from these Mesozoic sequences is also to be studied.

The basic stratigraphy in the Cooper, Pedirka, Simpson Desert and Eromanga Basins is given in Figs. 1.2 and 1.3.

The Cooper Basin is an infrabasin of the Mesozoic Great Artesian Basin (Fig.1.4). Epeirogenic downwarping of the craton in Late Carboniferous to Early Permian times initiated the Cooper Basin (Battersby, 1976). The Cooper Basin supplies gas to South Australia and New South Wales. Production figures for 1982 are 5,668 million cu m, (Durkee, 1983).

The Pedirka Basin has been defined by Wopfner (1972(a)) as a Permian infrabasin lying beneath the western Great Artesian Basin (Fig.1.4). The Simpson Desert Basin unconformably overlies the eastern part of the Pedirka Basin.

The Eromanga Basin is "the central one of three main Jurassic-Cretaceous downwarps in the east-central part of Australia" (Vine,

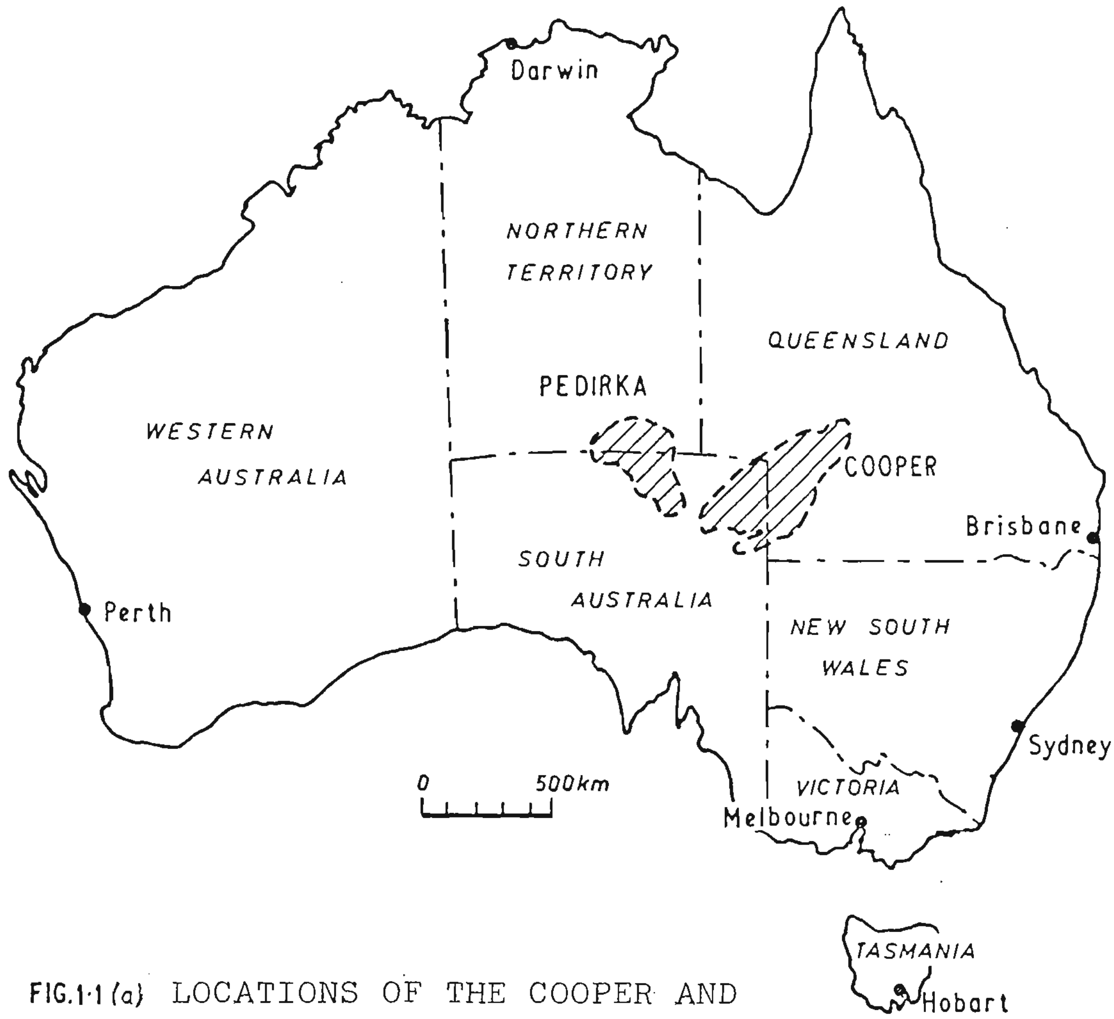


FIG.1·1 (a) LOCATIONS OF THE COOPER AND PEDIRKA BASINS. THE SIMPSON DESERT BASIN OVERLIES THE EASTERN PEDIRKA.

FIG.1·1(b) LOCATIONS OF THE GREAT ARTESIAN AND EROMANGA BASINS

1976). It is filled by "a thin and fairly uniform pile of sediments deposited on a stable craton which was being downwarped steadily and more or less uniformly during Jurassic and Cretaceous time". A number of major depocentres can be recognised within the Eromanga Basin and many of these overlie depocentres for the Permian sequences.

1. (ii) <u>Discoveries</u>

In 1959 Delhi Petroleum Pty.Ltd., drilled the first exploration well in the Cooper Basin, Innamincka 1, and oil shows were recorded. In 1963, gas was discovered at Gidgealpa, and the Moomba gas field was discovered in 1966 (Fig.1.5).

In the Pedirka Basin the major exploration effort, from 1958 to 1966, was on the western margin of the basin, where 6 dry holes were drilled. In 1977, Delhi drilled Poolowanna 1 and Macumba 1 to the east of the previous wells (Fig.1.5). Oil was struck in Poolowanna 1 in the Jurassic sediments of the Eromanga Basin, (Porter, 1978), but the discovery has so far proved to be non-commercial.

The Eromanga Basin has been explored for hydrocarbons since 1924, (Armstrong and Barr, 1982). Eleven significant discoveries have been made since 1975, of gas and oil, mostly from the Jurassic section, and two from the early Cretaceous. The fields are in both Queensland and South Australia. A very high success ratio has been characteristic of recent drilling in the Eromanga Basin.

1. (iii) <u>Hydrocarbon sources</u>

The hydrocarbons in the Cooper, Pedirka, Simpson Desert and Eromanga Basins are associated with essentially terrestrial and coal-bearing sequences. The sources for the hydrocarbons could be the coal seams, which represent concentrations of plant material, and/or the organic

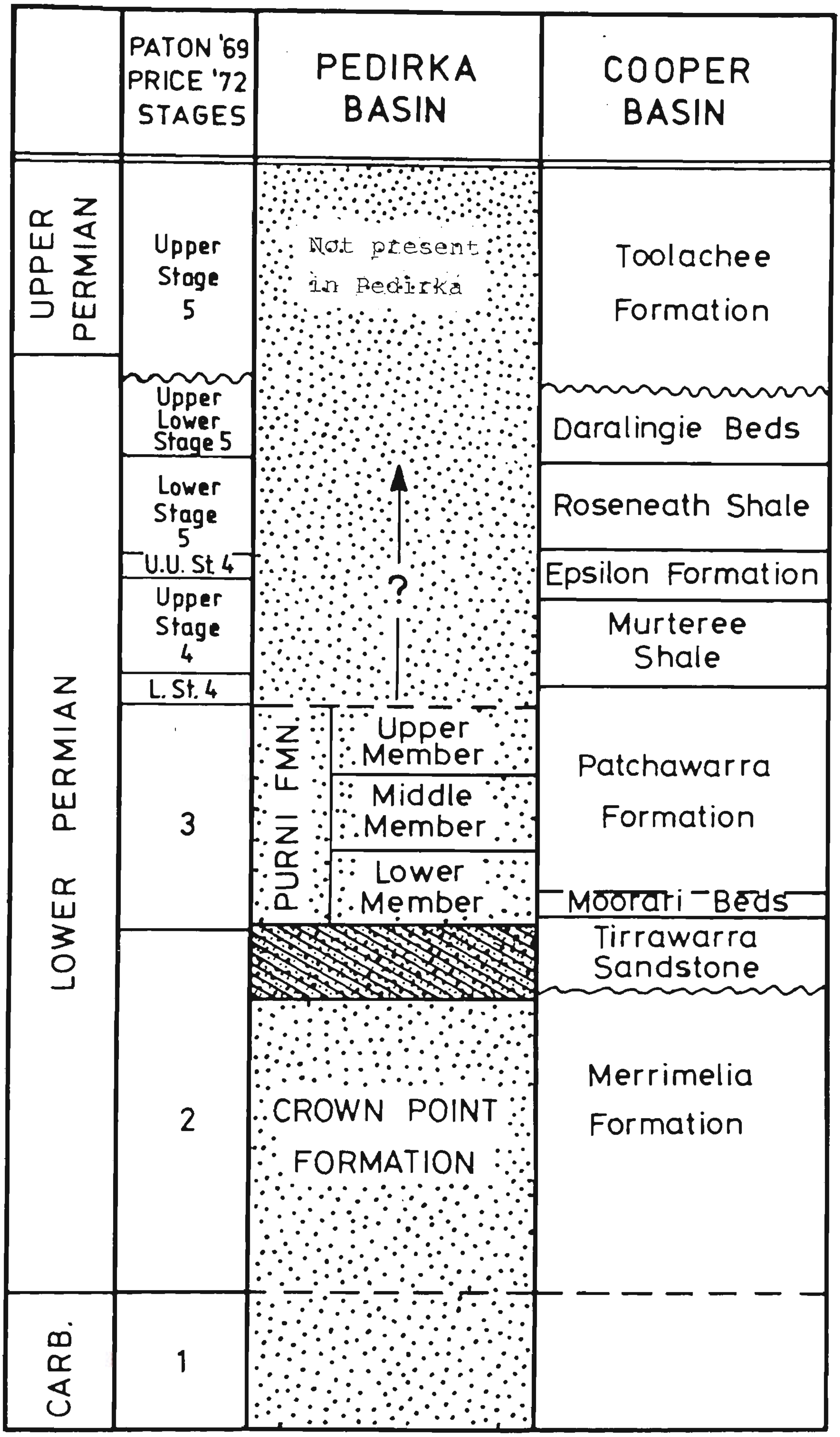


FIG.1.2 **PERMIAN STRATIGRAPHY IN THE PEDIRKA AND COOPER BASIN**
(after Porter 1978)

matter dispersed through the associated shales and siltstones.

Coal petrographic observations have supported a view that bituminous, petroleum-like substances form from liptinites and vitrinites, but that they do not escape from the coal seams (Stach et al., 1975, page 50) ... "In contrast to petroleum source rocks, from which the bitumen largely migrates, newly formed bitumen in coal cannot migrate, because the very fine submicroscopic pore system of vitrinite functions as a molecular sieve. The petroleum-like substances in coals are assimilated adsorptively and probably also chemically by the vitrinite with only a small part being deposited as exsudatinite in empty cavities". This view is repeated in Tissot and Welte, page 224 (1978). However, Durand and Paratte (1983) believe that significant amounts of oil can be formed in coals, and that this oil is likely to be expelled easier and sooner after its formation than from other source rocks.

In view of these two directly opposed opinions it is difficult to accept either as being true at this stage. Evidence from the present organic petrographic studies must be considered on its own merits, without the need to fit it to a preconceived theory, such as the two above.

The coal seams in the 4 basins have been studied to determine both the relationship of their petrographic types to that of associated dispersed organic matter and their source potential, and their possible use as indicators of depositional environments in the Cooper Basin.

1. (iv) Relationships between concentrated and dispersed organic matter

Coal seams and interbedded inorganic sediments in terrestrial environments form simultaneously. Plants in the regional will form part of either or both. The major purpose of this study is to determine whether a correlation exists between the petrographic composition of the coals

Stratigraphy in the Eromanga Basin (Jurassic-Cretaceous)

RECENT-TERTIARY	Eyre Formation		Recent-Unnamed
UPPER CRETACEOUS	Winton Formation		to
LOWER CRETACEOUS	Oodnadatta Formation		Roma Formation inclusive
	Toolebuc Formation		
	Bulldog Formation		
LOWER CRETACEOUS	Cadna-owie Formation		Transition Formation
LOWER CRETACEOUS to UPPER JURASSIC	Algebuckina Formation		Mooga to Birkhead Formations inclusive
LOWER TO MIDDLE JURASSIC	Poolowanna Beds		Hutton Formation
MIDDLE TO UPPER TRIASSIC	SIMPSON DESERT BASIN	Peera Peera Formation Walkandi Formation	COOPER BASIN
LOWER PERMIAN	PEDIRKA BASIN		

FIG. 1.3

<u>and that of the dispersed organic matter in the associated sediments.</u>

The composition of the coals and dispersed organic matter will be either similar or different. If similar, the dispersed organic matter may be regarded as coal which has been more or less diluted by mineral matter. Differences may occur in relation to a number of aspects and may be due to several causes. Certain parts of plants may be retained preferentially within the coal-forming areas, whilst others may be selectively removed by wind, water or biochemical attack. Biochemical coalification within sediments after their deposition may also give rise to changes in maceral composition. If such processes of differentiation operate, the coals and dispersed organic matter will have different petrographic compositions, but the differences may be systematic. Where the organic matter is substantially terrestrial, variations in type and quantity are related to the original plant types and depositional environments. The environment of formation of a coal and the carbonaceous shales immediately adjacent is similar, for example, alluvial plain, deltaic, lacustrine; but changes in the sedimentation balance may be associated with systematic changes in the maceral assemblages.

The advantage in establishing a relationship between coal type and the type of dispersed organic matter in associated rocks is that it is very easy to characterise the coal. In a core, or even in cuttings, it can be seen that coal is either bright, dull or interbanded. Bright coal invariably contains a high proportion of vitrinite, whereas dull coal usually has a high inertinite content.

Knowledge of the type of dispersed organic matter most likely to be associated with a particular coal type, together with an idea of the relative prospectivity of that dispersed organic matter, allows immediate

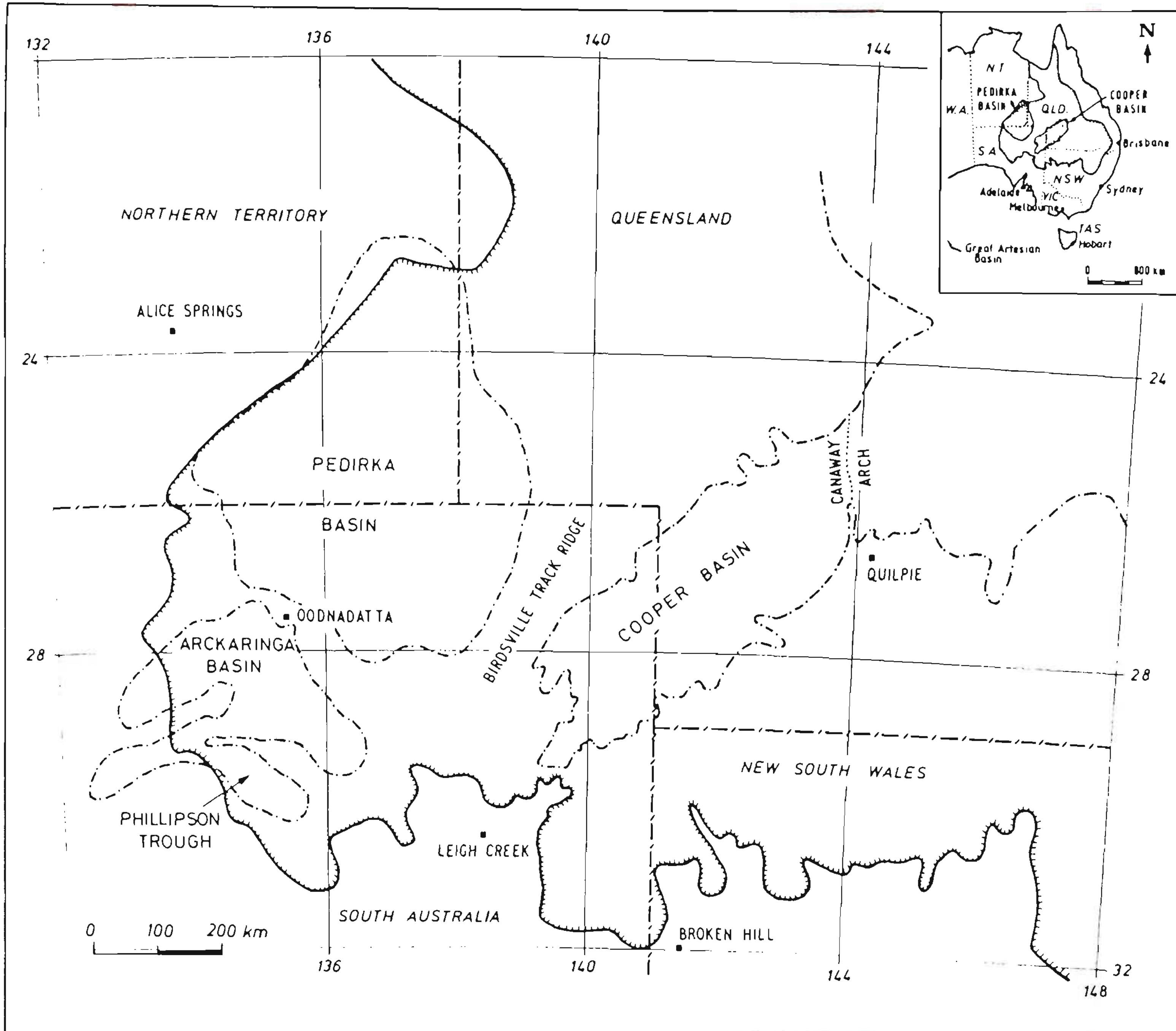


FIG. 1.4 -·-·- PERMO-TRIASSIC BASINS OF CENTRAL AUSTRALIA
GREAT ARTESIAN BASIN (JURASSIC-CRETACEOUS)

location of those rocks with the best oil generating potential. That is, suitable source rocks may be found simply by a macroscopic examination of coal in cores or cuttings.

A large volume of work has already been done on coal types and sedimentary basins (Shibaoka and Smyth, 1975). It was possible to predict that the Permian organic matter in the cratonic Cooper Basin would contain less exinite and vitrinite than the Jurassic organic matter in the cratonic Eromanga Basin. This is based on knowledge of the floristic changes from the Permian to the Jurassic (Cook, 1981), and the type of coal typical of Permian cratonic basins.

1. (v) Analytical technique

The coal seams and other sediments in the Cooper, Pedirka, Simpson Desert and Eromanga Basins have been studied using reflected and transmitted light microscopy for the identification and petrographic analyses (maceral) of the coal and dispersed organic matter. Where possible, microlithotype analyses were carried out on the coals, to relate them to dispersed organic matter and to use in the environmental investigation. Details of the analytical techniques are given in section 3.

1. (vi) Outline of order of studies

The project was initiated with a study of the organic matter in four wells from the Fly Lake - Brolga area of the Cooper Basin (Fig.1.6). The results suggested that dispersed organic matter highest in exinite occurs at particular horizons in the Permian sequence, possibly in association with coals which are relatively rich in vitrite plus clarite.

The area studied in the Cooper Basin, the Patchawarra Trough, (Fig.1.6) produces both liquid and gaseous hydrocarbons. The Permian sediments in it are late mature with respect to oil generation (oil deadline at 1.3% $\bar{R}_{max}$ vitrinite).

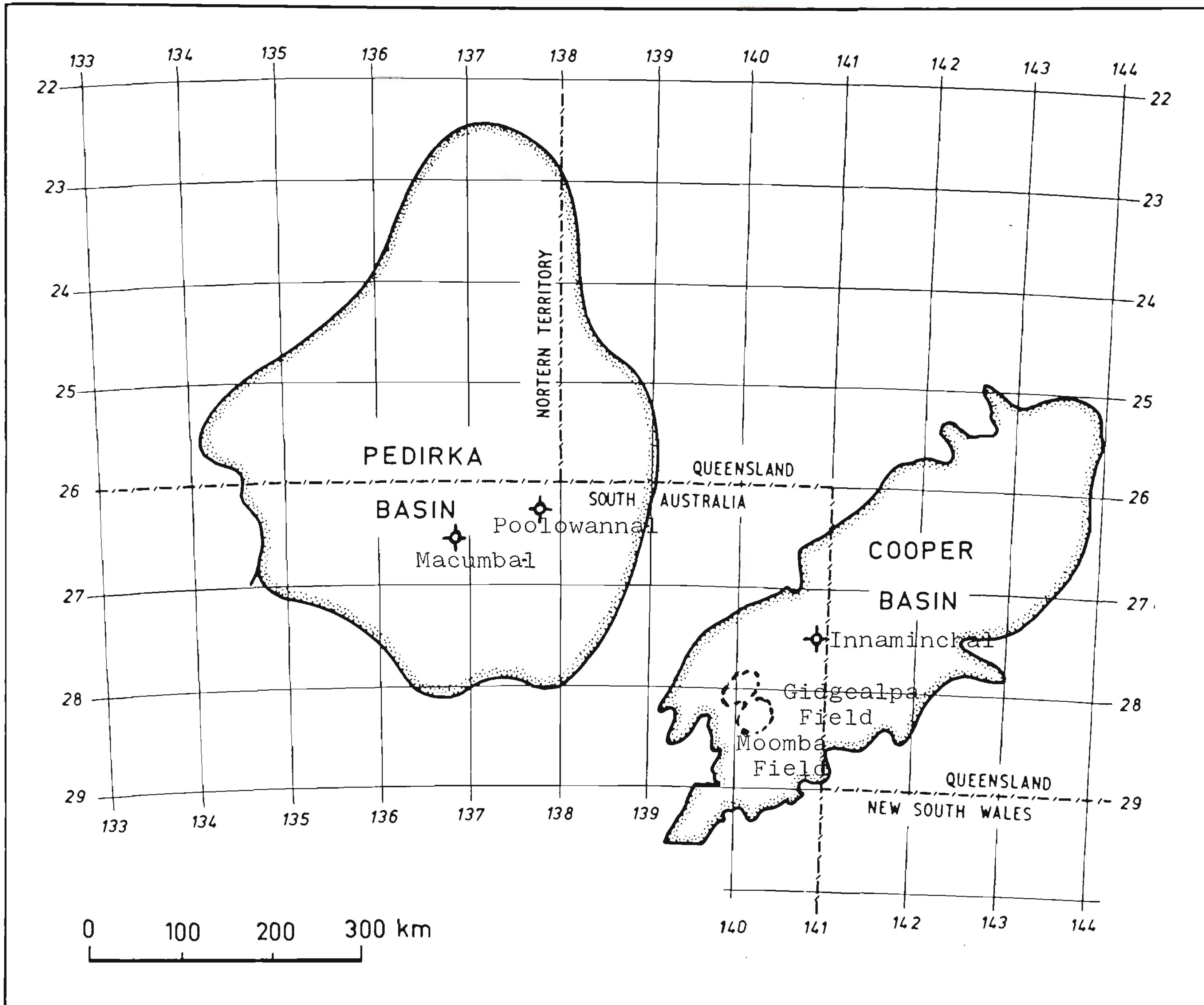


FIG 1.5 LOCATION OF WELLS IN THE PEDIRKA AND COOPER BASINS

Two other wells from the Patchawarra Trough, Mudrangie 1 and Tindilpie 1, were selected to determine whether a relationship in the organic matter similar to that found in the Fly Lake - Brolga area, exists elsewhere. The coals and dispersed organic matter were analysed quantitatively and the results were examined using statistical tests.

Similar analyses and tests were done on the coals and dispersed organic matter in the Pedirka, Simpson Desert and Eromanga Basins, where possible.

The microlithotype data compiled for the Permian coals of the Cooper Basin were used for relating coal compositions to depositional environments. Thornton (1978, 1979), has made a detailed study of the sedimentary environments in the Cooper Basin, based on the inorganic sediments. These palaeoenvironments were used for comparison with the microlithotype compositions of the coals. Some work of this nature has been published for the Permian coals of the Sydney Basin (Britten et al., 1975).

1. (vii) Rank and type of organic matter in the basins

The maturity of sediments in a number of Australian sedimentary basins has been covered extensively by Cook (1975) and Kantsler et al., (1978), and Kantsler et al., 1983. Their conclusions are that all sediments in the Cooper, Pedirka and Simpson Desert Basins and parts of the section in the Eromanga Basin are sufficiently mature to have generated hydrocarbons.

Very little information has been published on the petrography of the dispersed organic matter in Australia's sedimentary basins (Kantsler and Cook, 1979; Cook, 1982a). The only published quantitative data on the coals and dispersed organic matter from the Cooper Basin are those in Smyth (1979); on the Pedirka and Simpson Desert Basins, in Smyth and

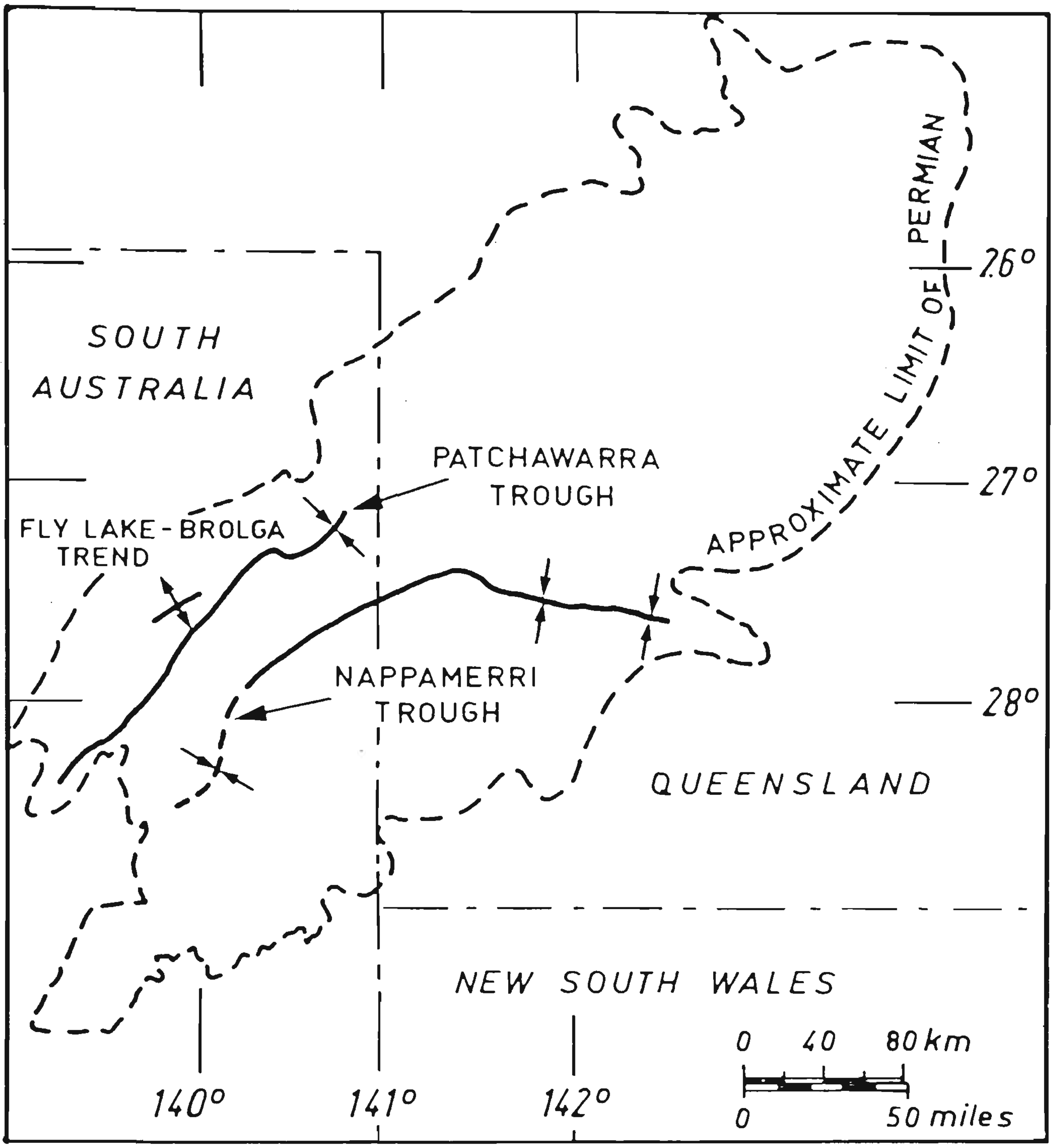


Fig. 1.6 Location of the Fly Lake - Brolga Trend in the Patchawarra Trough, Cooper Basin.

and Saxby (1981); and on the Eromanga, in Smyth and Cameron (1982).

1. (viii) Summary of aims

This study is designed to elucidate:

(a) The relationships between the macerals of coals and dispersed organic matter in associated sediments.

(b) The relationships between coal microlithotypes and dispersed organic matter macerals.

(c) The locations of good source rocks for hydrocarbons, in the Cooper, Pedirka, Simpson Desert and Eromanga Basins.

Also to investigate,

(d) The usefulness of coal microlithotypes as indicators of depositional environments in the Cooper Basin; and further, from this information to determine the depositional environments which have produced the best source rocks for hydrocarbons.

2. PREVIOUS WORK

2. (i) Petrology and geochemistry of source rocks

Papers published to date, specifically on the relationship between the organic petrology of dispersed organic matter and associated coals, are those of Smyth (1979) and Smyth and Cameron (1982). In Smyth (1979) this relationship was assessed using semi-quantitative data from the Permian sediments of the Cooper Basin. Results suggested that in the area studied an increase in the amount of dispersed exinite accompanies an increase in the vitrite plus clarite content of associated coals.

Smyth and Cameron used a statistical method to relate quantitative data on Jurassic coals and dispersed organic matter from the Eromanga Basin. The ratio of dispersed exinite to dispersed inertinite is reasonably well predicted by the ratio of exinite to inertinite in the associated coals.

In his review of the origin of petroleum, Stevens (1956) remarked on "the many instances of geographical and geological association of coal and oil" which have led some investigators "to conclude that crude oil may be derived from coal". However, oil-like mixtures from coal and oil shales are richer in aromatic hydrocarbons than most crude oils. Cook (1982b) proposes that coal is a source for liquid hydrocarbons as do Durand and Paratte, (1983).

Hedberg (1968) writes that the "high wax content of crude oils appears to be an original characteristic related to genetic environment or the kind of organic matter from which the oil was derived". The high wax crudes are commonly associated with coal or highly carbonaceous strata, are of a non-marine or low salinity water origin, and occur in continental, paralic or near-shore marine environments.

Brooks (1970) considered it probable that the same original plant material may have been the progenitor of both coals and petroleum depending upon the conditions under which biochemical and early geochemical alteration took place. He thought it likely that Australian oil occurrences, most of which are associated with coal-bearing sediments, have formed from land plant residues finely disseminated in shales and siltstones.

most
The proposal that/Australian oils are formed from land plant debris is supported by Powell and McKirdy (1973). They state that high wax oils are the rule, rather than the exception in Australia. "Leaves, pollen and spore cuticles of terrestrial plants seem to have contributed significantly to the source material of crude oil".

Tissot (1977) lists three conditions which must be realised to generate petroleum or gas from a possible source rock:

"(i) a sufficient amount of organic matter". (Favero et al. (1979) claim that, in the continental environment, dispersed organic matter concentration attains its maximum in clays interbedded with peat).

"(ii) The right quality of organic matter: the chemical composition of kerogen should be favourable for a high yield of oil and gas upon burial".

"(iii) The maturation of the source rock: the thermal history of the source rock should be such as to produce a significant part of the petroleum which could be expected from the nature of the organic matter".

Ultimate analysis data using H:C and O:C atomic ratios have been used by Tissot et al., (1974) to define three main types of kerogen. Type 1 kerogens have originally a high hydrogen content and a low oxygen content, such as may be derived from an accumulation of algae or microbial reworking of various kinds of organic matter, leaving mostly the lipid fraction of the original material, together with microbial lipids. Type I kerogen has a high source-potential for liquid petroleum.

Type II kerogen has a moderately high original hydrogen content, but lower than Type I. Type II is usually derived from marine phytoplankton and zooplankton laid down in a confined environment. Type II also includes spores, pollen and Gloeocapsomorpha (Cook et al., 1981).

Type III kerogen has a low hydrogen content and a high original oxygen content. It is mostly derived from higher land plants. Tissot et al., (1974) and Tissot and Welte (1978) suggest that it has a low potential for oil, but can be a good source for gas at depth.

The evolutionary paths of the three kerogen types as expressed by atomic H/C and O/C ratios, have been compared with those of coal macerals expressed in the same way (Fig.2.1)."The evolution path of Type I resembles the carbonization path of alginites. The kerogen Type III, rich in material from higher plants, has an evolution path comparable to that of vitrinite. The other evolution paths, like Type II, occupy an intermediate position, as exinite does", (it should be noted that alginite is an exinite) "but the H/C ratio may be higher or lower according to the particular formation: (Tissot et al., 1974).

Coal petrologists divide this "higher land plant" material into vitrinite and inertinite. Vitrinite has a higher hydrogen content than inertinite, and some vitrinites probably have significant liquid generating power. Also vitrinite is overall much more abundant than liptinite, even if it does give a smaller yield of liquids.

Smith and Cook (1980) have demonstrated that inertinite is rapidly coalified in low rank coals. This, together with the fact that low rank inertinite is reactive in hydrogenation processes (Mitchell et al., 1977), suggests that inertinite may generate hydrocarbons.

Saxby (1977, 1978) agrees with the findings of Tissot et al. "Lipid-derived material is the principal source of oil, while lignin-related kerogen gives methane as its main gaseous hydrocarbon product." He also writes "the maximum quantity of oil derivable from vitrinite is relatively small and most interest in petroleum exploration concerns more hydrogen-rich kerogen, which falls above the vitrinite line in H/C versus O/C diagrams".

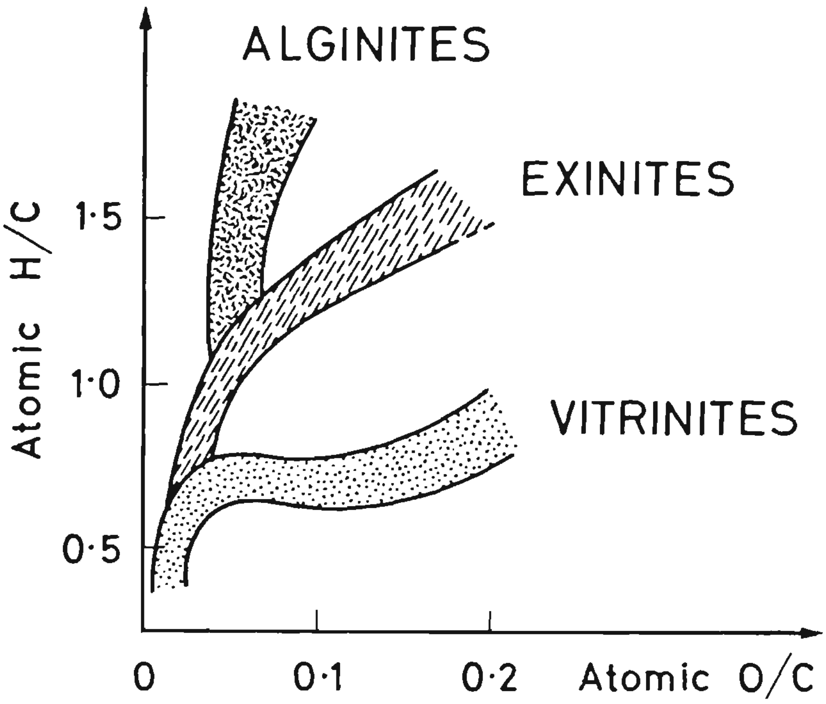
McDowell (1975) also agrees that "the precursor of oil is indicated to be the algal-rich kerogen disseminated in fine-grained sediments deposited under reducing conditions and normally comprising no more than 10% of the total organic matter."

Larter et al., (1977) suggest that sporinite-type kerogen, with suitable geothermal conditions, might give a heavy, waxy crude; alginite-type might give a lighter petroleum richer in gasoline/kerosine fractions, and vitrinite-type kerogen would give predominantly gaseous products.

Grunau and Gruner (1978) are of the opinion that the part of natural gas which is thermally degraded oil and that which stems from a gas source rock cannot be satisfactorily distinguished at present. Thus, gas in a province could be due to high levels of maturation or the effects of gas prone source material.

Allan and Douglas (1973) treated a series of vitrinites and sporinites from bituminous coals (high-to-low-volatile, carbon 77-87% in vitrinite) by solvent extraction, saponification, oxidation and pyrolysis of the

(a) COAL MACERAL EVOLUTION PATHS



(AFTER VAN KREVELEN, 1961)

(b) KEROGEN EVOLUTION PATHS

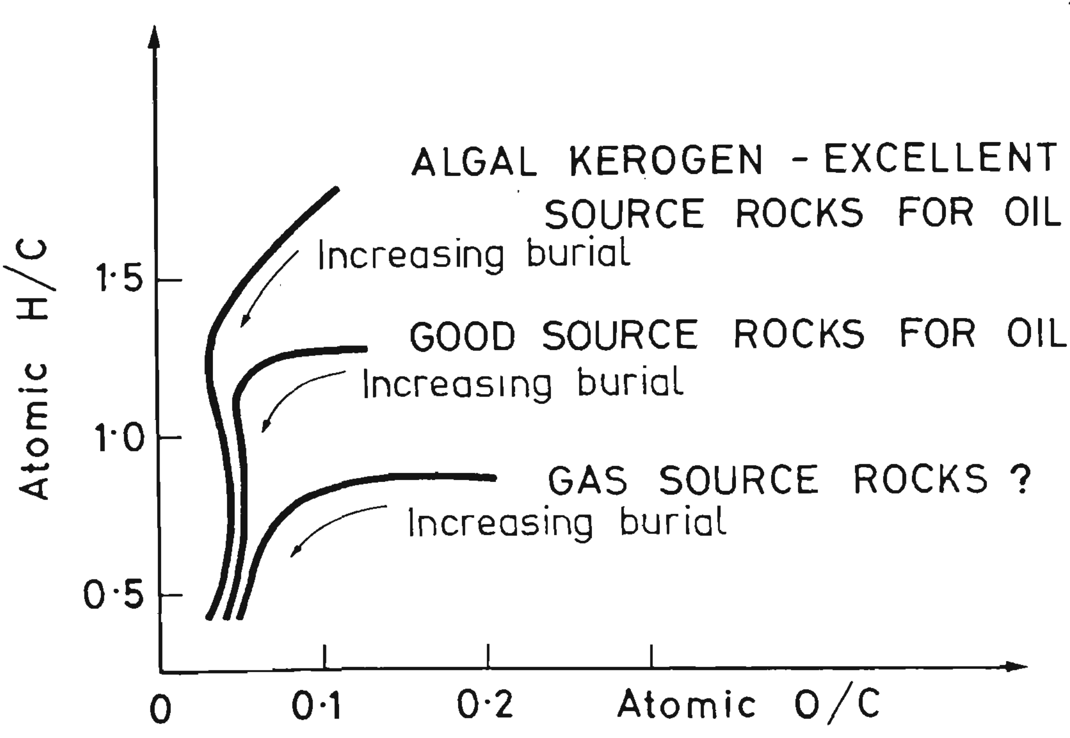


FIG. 2.1 (AFTER TISSOT etal, 1974)

extracted residues. At 257°C, low rank sporinite yielded a much larger saturated hydrocarbon fraction than the corresponding vitrinite, with the difference in amount growing less with increasing rank. At 375°C sporinites also yielded greater amounts of saturated hydrocarbons than the corresponding vitrinites, but the ratio was twentyfold at low rank and only twofold at the highest rank.

Staplin et al., (1974) regard "sapropel" as the source of petroleum, in agreement with Potonié (1908, 1910). All classes of organic matter except fusain can, in Staplin's opinion, be converted to sapropel. Algal debris is readily converted; cuticle and spore are more resistant, but can also be converted.

In the Gippsland Basin off southeastern Australia the carbonaceous material in the coals is mostly vitrinite (Shibaoka et al., 1978). These authors relate most of the oil to the lipid-rich exinite material, rather than the vitrinite.

Dow (1977) has summarized the basic tenets behind source rock investigations: "These three parameters; the amount, type, and maturity of organic matter in sedimentary rocks, form the basis of all source rock studies ..... The liptinite and vitrinite maceral groups of coals are important because they are capable of yielding petroleum. A third maceral group inertinite, is also important because it has virtually no convertibility to hydrocarbons ..... large percentages of inertinite macerals in rocks would therefore not indicate favourable source capabilities even though organic carbon contents may be high". In the Cooper Basin sedimentary rocks the inertinite forms 70-90% of the DOM and 30-90% of the coals (Smyth, 1983). The Cooper Basin produces oil commercially, so that Dow's statement is not always applicable.

All of the above studies support the idea that alginite is the best source material for the generation of petroleum, but that the other exinites - sporinite, cutinite, resinite - can also be good sources and perhaps even vitrinite to a small extent. Vitrinite is more commonly regarded as a source of gaseous hydrocarbons. Smith and Cook (1980) suggest that over the rank range corresponding to 0.4% to 1.1% vitrinite reflectance, inertinite may generate some hydrocarbons.

Snowdon (1978) made a geochemically oriented study of sediments from three sub-enviroments - fluvio-deltaic (continental) to prodelta (marine) facies, within the Upper Cretaceous-Tertiary delta complexes of the Beaufort-Mackenzie Basin. He found no correlation of the organic matter type and the widely varying environments of deposition. The only environment-specific chemical parameter observed was total organic carbon which was significantly higher in the fluviodeltaic samples than in the delta front and prodelta samples. The predominantly land derived organic matter was dominant during the deposition of the delta complex even during transgressive phases. No classical sapropel-rich source rocks were identified. Good or excellent potential source rocks were identified and were interpreted to be related to resinous organic material. The good source potential was not related to any particular geological process.

Powell et al., (1976) used the point-counting technique on dispersed organic matter in Carboniferous sediments from cyclothems in northern England. They counted vitrinite and exinite in marine and terrestrial rocks, and found that limestones contained only traces of vitrinite and shale contained varying amounts of discrete particules of vitrinite and exinite. No clear distinction was evident between the maceral content of marine and non-marine shales. The principal exinite components in the shales were spores, plus some resin globules and comminuted algae. Amongst the coal macerals, vitrinites had higher extract yields than sporinites of comparable rank, but the hydrocarbon content of the sporinite extract was higher than that of the vitrinites. The proportion of hydrocarbons in the extracts was highest in those samples with a high maceral content.

Thus, the work of both Snowdon and Powell et al., implies that no preference for the occurrence of source rocks in a marine environment rather than a terrestrial one has been established in paralic or deltaic areas of deposition. If anything, the amount of organic matter is higher in the terrestrial rocks.

Hutton et al., (1980) imply a higher frequency of occurrence of alginite in the lacustrine environment. This occurrence is, however, extended if dinoflagellate and acritarch cysts are included in their alginite B category.

Cook (1975, 1981) has drawn attention to the systematic variation in coal type with age. He considered this to be primarily caused by floristic changes, associated with the evolution of the plants with other influences such as climate having a significant but secondary effect. In addition to affecting the petrographic composition of the coals, the floral changes were considered to affect the composition of dispersed organic matter in associated sediments. Cook (1981) suggested that significant differences in the source potential of terrestrially-derived organic material can be associated with these systematic changes.

Thomas (1982) has acknowledged the land-plant origin of most Australian hydrocarbons ..... "most Australian pre-Jurassic coal measure sequences are deficient in exinite macerals and are therefore mainly gas-prone.

In contrast, Jurassic to Tertiary coal-rich sequences often contain abundant exinite and may have substantial potential to generate oil in commercial quantities, as demonstrated by the well-known Gippsland Basin oilfields." Durand and Paratte, (1983) concluded that most coals can be oil source rocks, regardless of age.

2. (ii) Depositional environments

The sediments in the Cooper Basin are terrestrial in origin (Battersby, 1976; Stuart, 1976), although Thornton (1978, 1979) regards two of the formations (the Murteree and Roseneath Shales) as possible restricted seas or lakes (Table 2.1). No direct evidence for a marine origin has yet been found.

Stuart (1976) considers that the environments represented in the southern Cooper Basin include lakes, or large bodies of standing water, flood plain, delta plain, coastal plain and perhaps lagoons. The sediments are examples of near-shoreline deposits. In the Patchawarra Trough, the lower portion of the Patchawarra Formation (Table 2.1) becomes typical of lake sedimentation towards the southeast. The intercalated coals and channel-lag and point bar sandstones in the middle part of the Patchawarra Formation also grade laterally into lake and deltaic deposits towards the Nappamerri Trough (Fig.1.6). In the upper portion of the formation the sedimentary rocks represent a return to deltaic and lake deposition towards basin margin areas.

Thornton has made the most detailed reconstruction of the palaeogeography of the Gidgealpa Group of the Cooper Basin (1973, 1978, 1979). Because his work has been referred to extensively throughout the rest of the text, a detailed summary of his palaeogeography follows.

The Tirrawarra Sandstone (Table 2.1) was deposited from braided streams. A change from Tirrawarra Sandstone to Patchawarra Formation was due

TABLE 2.1. Permian stratigraphy and depositional environments in the Cooper Basin. The building up of the Cooper Basin stratigraphy is due to the work of several authors including Kapel (1972), Papalia (1969) and Gatehouse (1972).

AGE	PALYNOLOGICAL STAGES	FORMATION	DEPOSITIONAL ENVIRONMENT in the (Thornton, 1979) Patchawarra Trough	
UPPER PERMIAN	Upper Stage 5b	Toolachee	Meandering river system	Upper Stage 5'
LOWER PERMIAN	Lower Stage 5b	Daralingie Beds		
	Lower Stage 5a	Roseneath Shale	Lake or restricted sea	
	Upper Stg.4b	Epsilon	Lakes, shoreline swamps	Epsilon Formation
	Upper Stg. 4a	Murteree Shale	Lake or restricted sea	
	Lower Stg.4 3	Patchawarra Moorari Beds	Meandering streams to paludal coal-forming	Upper Stg.4 Lower Stg.4 Stage 3'
		Tirrawarra Sand-stone	Braided streams	Tirrawarra Ss.
	2	Merrimelia		
CARBON-IFEROUS				Units used by Thornton (1979)

to a change to meandering stream environments from west to east. Depositional environments during Stage 3' ranged from a fluvial regime on an alluvial plain to paludal. The depositional regime in the Patchawarra Trough was different from the remainder of the Cooper Basin. The depositional surface in the Patchawarra Trough was a smooth, mature land surface and the Stage 3' section is very thick. Depositional environments were suitable for coal formation.

In Lower Stage 4 (Table 2.1), north of the Gidgealpa-Merrimelia-Innamincka trend in the Patchawarra Trough, deposition from meandering river systems dominated, but deposition in lakes was more common in the southern part of the basin. In the Patchawarra Trough the section is thin and includes abundant coals.

During Upper Stage 4' time deposition in the Patchawarra Trough occurred mostly in lakes. The rest of the Cooper Basin was in most areas permanently covered by water. By the end of the period, topographic highs in the east to the southeast part of the basin, which had been emergent during earlier stages, were finally covered. Upper Stage 4' is a transition unit from meandering river to lacustrine deposition.

The overlying Murteree Shale was deposited throughout most of the basin from a large body of water, either a restricted sea or a fresh-water lake. No evidence of marine conditions have been found, so a restricted sea origin is unlikely.

The Epsilon Formation records the eastward withdrawal of the Murteree Lake. It was deposited mostly in lakes and interdistributary bays and in swamps on top of shoreline sands. The Epsilon Formation is thin in the Patchawarra Trough.

The Roseneath Shale was deposited from a lake, and has a similar

TABLE 2.2 Stratigraphy and Depositional Environments in the Pedirka Basin

AGE	PALYNOLOGICAL STAGES	FORMATION	DEPOSITIONAL ENVIRONMENT
LOWER PERMIAN		PURNI: Upper Member	Coalsdeveloped Terrestrial sands and shales
	3	PURNI: Middle Member; Lower Member	
	2	CROWN POINT	Glacial diamictites, sands and shales
CARBON-IFEROUS			

origin to the Murteree Shale. The 'Daralingie Beds' are deltaic in origin.

Upper Stage 5' - the Toolachee Formation - was laid down on a surface of low relief from a meandering river system. Deposition in the Patchawarra Trough was thin, mainly overbank deposits in the north.

Other workers have demonstrated that the Upper Carboniferous and Permian beds in Australia contain evidence of extensive glaciation (Crowell and Frakes, 1975). Steep magnetic inclination (84°) suggests a high latitude. Stuart (1976) considers that climatic variation could partly account for some of the larger scale cyclic phases of fluviatile influx of sediments and oscillating advances and retreats of the 'lakes'.

2. (iii) Pedirka, Simpson Desert and Eromanga Basins

The Pedirka Basin has been defined by Wopfner (1972a) as a Permian infrabasin lying beneath the Western Great Artesian (or Eromanga) Basin. (Fig.1.1(a)). Porter (1978) has reviewed the results of twenty years exploration, from its beginnings in 1957, in the Pedirka Basin. Several exploration wells have been drilled through the Great Artesian Basin and underlying basins, but most were dry holes.

Such information as is available on the geology of the Pedirka Basin has been summarized by Youngs (1975, 1976); Devine and Youngs (1975) and Moore (1982). Youngs described the Lower Permian sediments as comprising two formations: "The lower is a series of glacial diamictites, sands and shales" (Crown Point Formation). "The upper formation contains terrestrial sands and shales with the development of coals in the upper layers". (Purni Formation). "The Permian lies at depths of only a few hundred metres in the west and dips to over 2500 metres in the deepest parts which lie towards the eastern margins," (of the

Pedirka Basin), (Table 2.2).

The stratigraphy of the Permian sequence in the Pedirka Basin is shown in Fig.1.2, which also shows the equivalent Cooper Basin stratigraphy. The Patchawarra Formation of the Cooper Basin is equivalent to the Purni Formation in the Pedirka Basin (Porter, 1978).

The name "Simpson Desert Sub-basin was used first by Williams (1973) to describe the early Permian sediments of the eastern Pedirka Basin. Williams described "an additional sediment package .... at depths of 2000-3000 metres between Lower Permian and Lower Jurassic sections. This sediment package .... may be Middle to Upper Permian and/or Triassic in age". Subsequently, the Triassic sediments in this deeper eastern part of the basin have been named, as yet informally, the Simpson Desert Basin (C. Porter, Western Mining Corporation, personal communication, March, 1980; Moore, 1982).

The Cretaceous section contains over 600m of marine shale, and might contain good source rocks. However, the Cretaceous section is immature (Cook, 1975; Kantsler et al., 1978). the depositional conditions during the Jurassic were dominantly fluviatile, with lacustrine intervals to the east.

3. THE PETROGRAPHY OF ORGANIC MATTER IN THE PATCHAWARRA TROUGH, COOPER BASIN, FROM THE FLY LAKE-BROLGA AREA

3. (i) Analytical techniques

Cores taken for porosity testing during drilling of the wells in the Fly Lake - Brolga area were supplied to the author by Delhi Petroleum Pty.Ltd. for petrographic analyses. Although cores are the most reliable samples of particular horizons, their coverage of the whole rock sequence in a well is very limited, unless the hole has been fully cored. This is not the case in the petroleum exploration wells in the Cooper Basin. (Cutting samples were used for petrographic analyses of other wells because of the limited availability of cores).

Thin sections and polished blocks were prepared from the cores of inorganic sedimentary rocks from the Fly Lake - Brolga wells (pieces 25-30mm in length).

The thin sections of the sedimentary rocks were examined using transmitted light to assess the quantity and mode of occurrence of any dispersed organic matter present. The dispersed organic matter was divided into translucent and opaque types, and approximate ratios of one to the other estimated. $\bar{R}_v$max ranges from 0.8 to 1.1% (p43).

Polished blocks of the same samples were viewed under incident light with oil immersion and fluorescence mode with a 450 to 490nm excitation filter, 510nm dichroic reflector and a 500nm barrier filter. Blue light will cause any exinite present to fluoresce yellow to orange at $R_v$max 1.2%. (International Committee for Coal Petrology, 1971, 1975). Using high magnification in the microscopic examination, it is possible to reject most of the occurrences below the surface.

Fig.3.1. Photomicrograph of inertodetrinite (I) and vitrinite (V) from the Patchawarra Formation; x 300.

Fig.3.2. Photomicrograph of inertodetrinite (I) and semifusinite (SF), from the Tirrawarra Formation; x 300.

Fig.3.3. Photomicrograph of inertodetrinite (I) from the Patchawarra Formation; x 280.

Fig.3.4. Photomicrograph of inertodetrinite (I) and mineral matter (M) from the Tirrawarra Formation; x 300.

Fig.3.5. Photomicrograph of inertodetrinite (I) and vitrinite (V) in layers of inertodetrite/vitrinertite; x 300.

Fig.3.6. Photomicrograph of semifusinites (SF) from the Patchawarra Formation; x 300.

All photomicrographs are in reflected plane polarised light, with oil immersion.

Fig. 3.1

Fig. 3.2

Fig. 3.3

Fig. 3.4

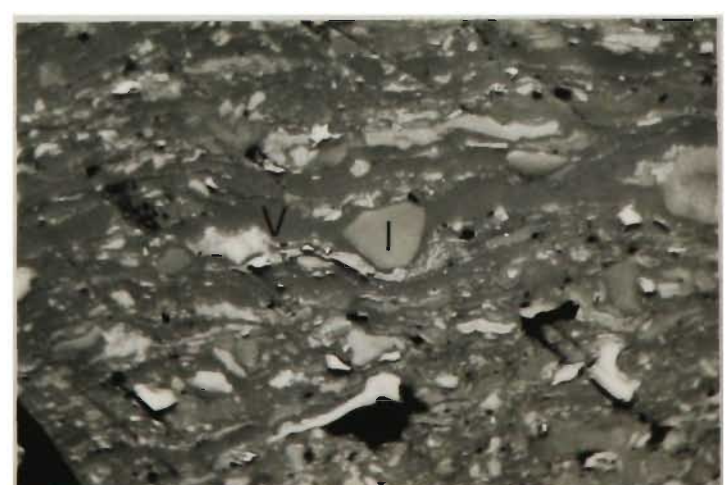


Fig. 3.5

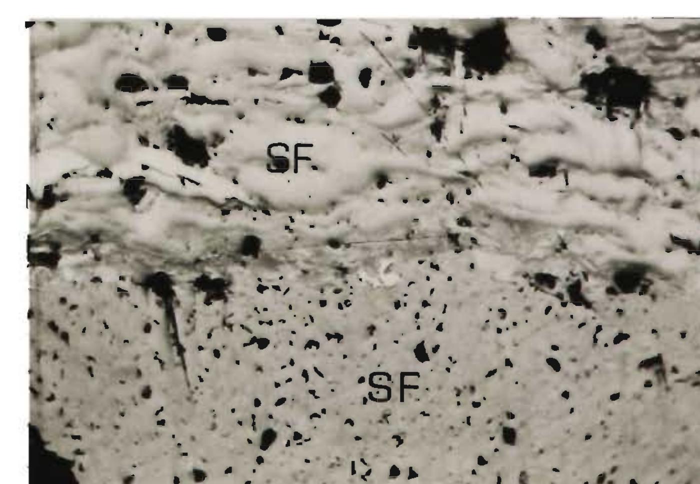


Fig. 3.6

Lumps of coal were supplied (after selection by Delhi geologists) every 10 to 20cm from available cores, providing a large number of coal samples through the 4 wells. The samples are not strictly representative of the seams from which they were taken and may show bias towards some categories of petrographic composition. However, the large number of lumps should provide a relatively precise indication of the petrographic compositions of the seams by minimizing systematic bias.

The lumps were crushed to -1mm and prepared as polished grain mounts. They were petrographically analysed, using reflected light and oil immersion, by the point counting technique. Both maceral and micro-lithotype analyses were carried out in accordance with the recommendations of the International Committee for Coal Petrology (1963, 1971, 1975).

3. (ii) The petrography of Patchawarra Trough coals

The most outstanding feature of the Gidgealpa Group coals in the Patchawarra Trough is their high inertinite content.¶ Inertodetrinite is the most abundant inertinite maceral.* It is present with vitrinite in vitrinertite (Fig.3.1); associated with semifusinite in microite (Fig.3.2); massed together as inertodetrite (Fig.3.3); and mixed with mineral matter in shaly coal (Fig.3.4). Fig. 3.5 shows coal typical of the Lower Permian Patchawarra Formation, and illustrates inertodetrinite of low to high reflectivity, with minor, thin vitrinite bands.

Semifusinite, with minor fusinite, occurs throughout the coals (Figs.3.6, 3.7). The botanical structure in the semifusinite varies from well-defined, almost bogen structures (Fig.3.8), through lenses with only a few cellular structures preserved (Fig.3.9), to lenses with virtually no cellular structure and marked anisotropy (Fig.3.10).

¶ Typical analyses are given in Tables 3.5 to 3.8 in the Appendix
* See Fig.4.12, page 70

Fig.3.7. Photomicrograph of fusinite (F) from the Tirrawarra Formation; x 300.

Fig.3.8. Photomicrograph of semifusinites (SF) with well-preserved botanical structures from the Patchawarra Formation; x 300.

Fig.3.9. Photomicrograph of semifusinites (SF) with few botanical structures preserved, especially the central lens, which has virtually no botanical structure but does show anisotropy, from the Patchawarra Formation; x 300.

Fig.3.11. Photomicrograph of groundmass macrinite (MA) from the Patchawarra Formation; x 300.

Fig.3.12. Photomicrograph of groundmass macrinite (MA) from the Tirrawarra Formation; x 300.

Fig.3.13. Photomicrograph of groundmass macrinite (MA) from the Patchawarra Formation; x 300.

All photomicrographs are in reflected plane polarised light, with oil immersion.

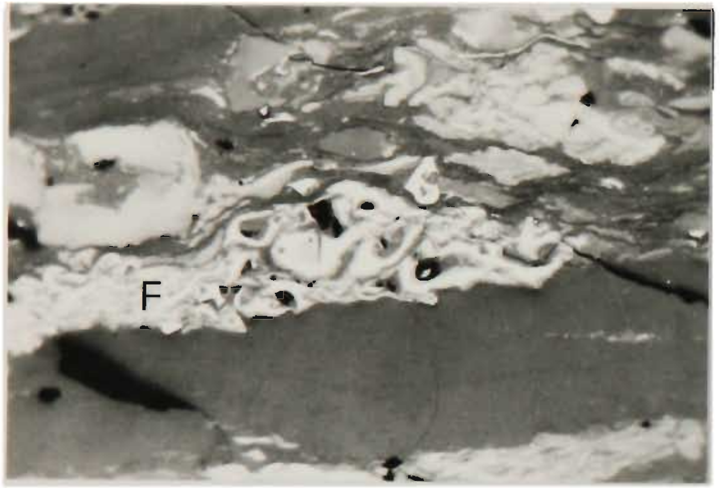


Fig. 3.7

Fig. 3.8

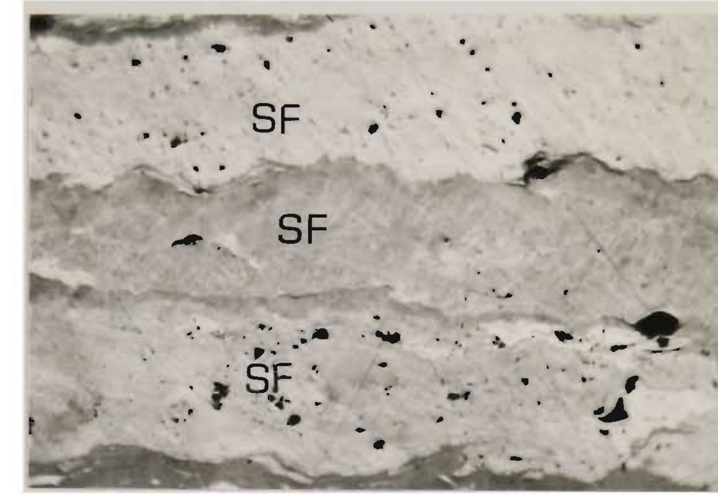


Fig. 3.9

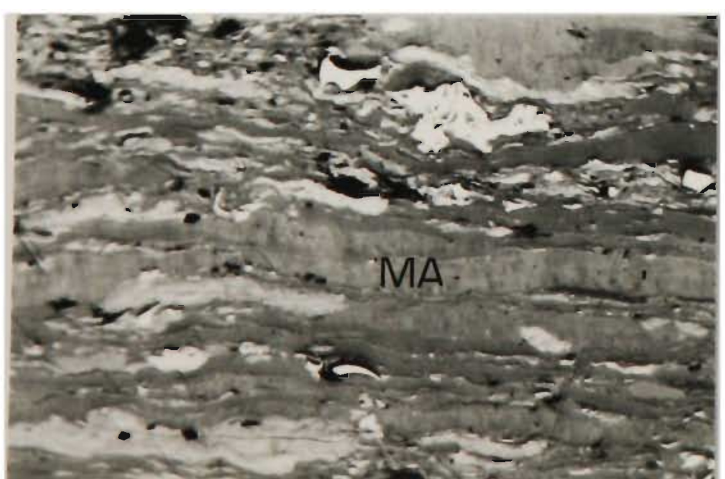


Fig. 3.11

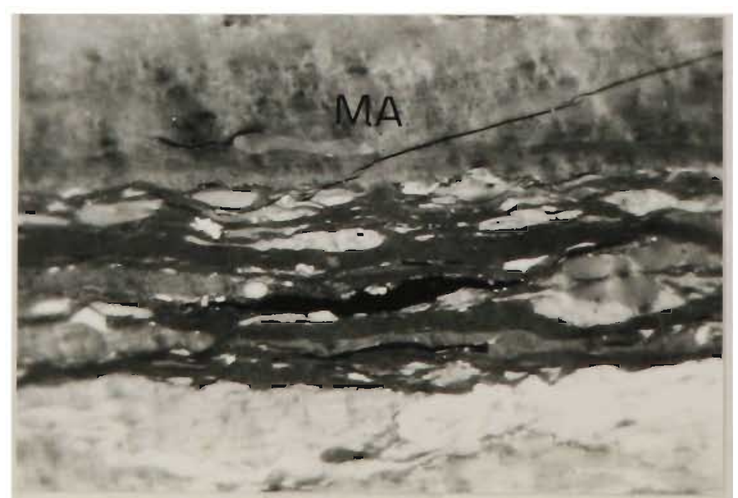


Fig. 3.12

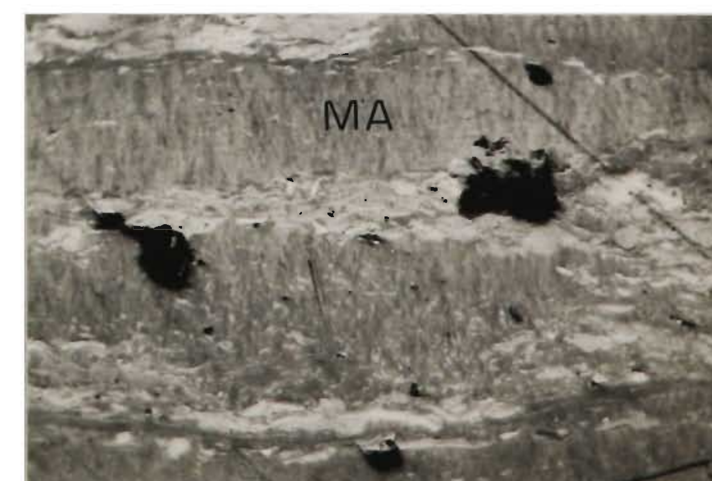


Fig. 3.13

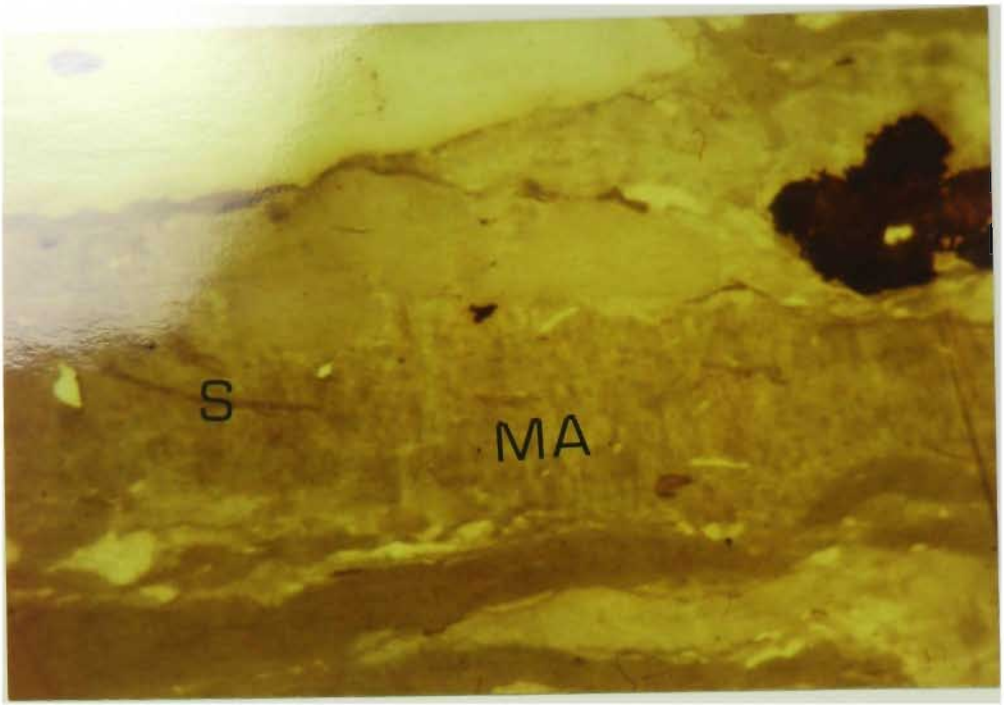


Fig. 3.10(a)

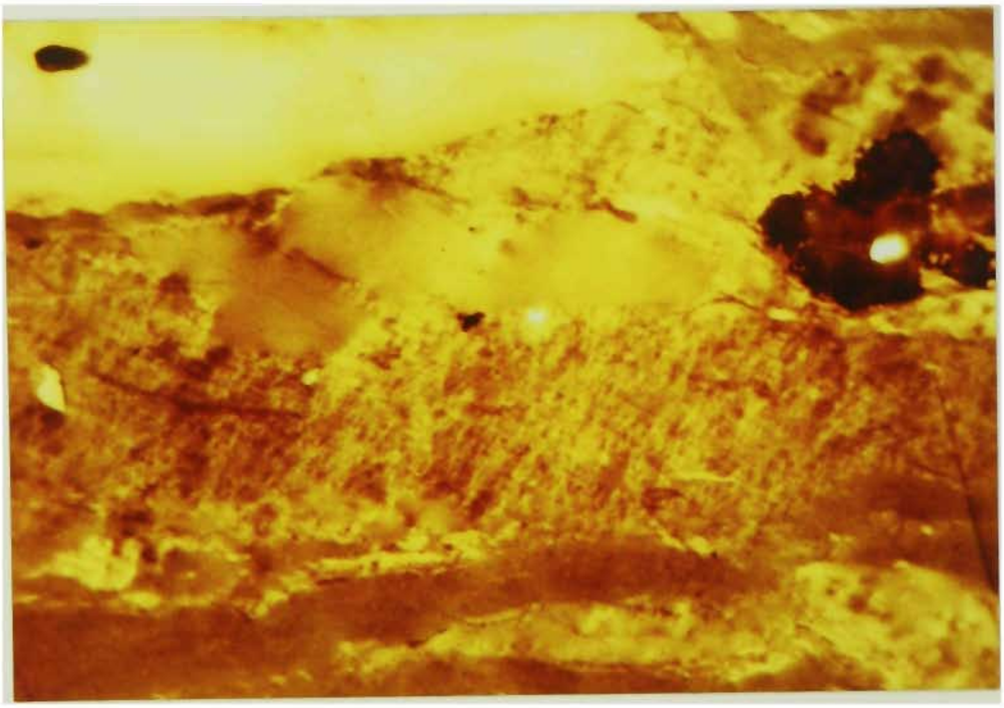


Fig. 3.10(b)

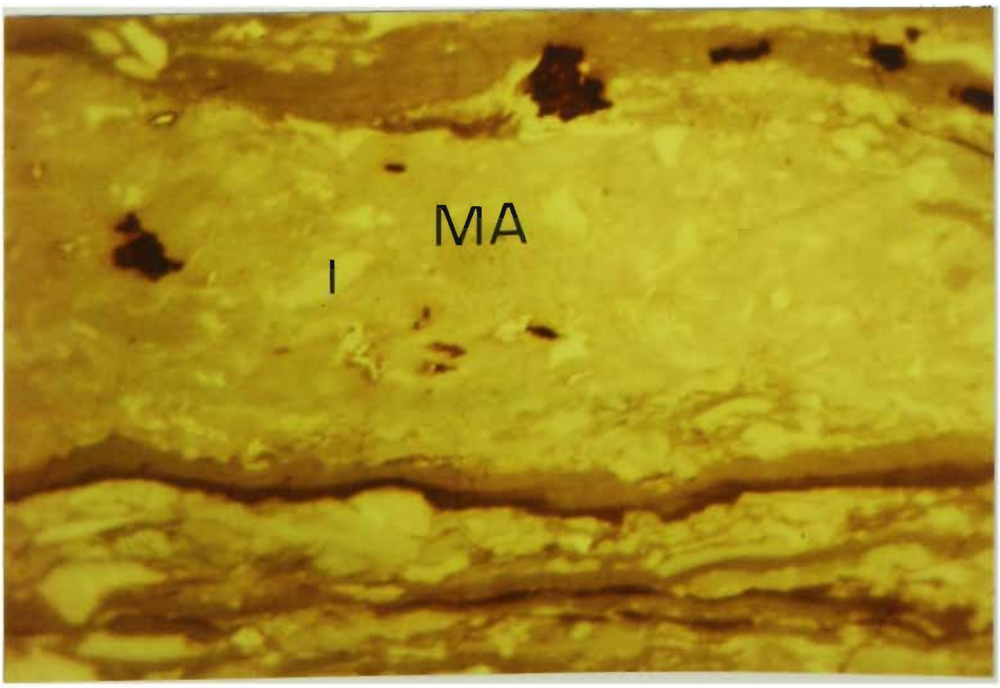


Fig. 3.14

Fig.3.10. (a) Photomicrograph of massive anisotropic inertinite (MA) with inclusions of sporinite (S) from the Patchawarra Formation. Reflected plane polarised light, oil immersion; x 465.

(b) Same as above, but with partly crossed nicols.

Fig.3.14. Photomicrograph of groundmass macrinite (MA) with inclusions of inertodetrinite (I) from the Patchawarra Formation; x 465. Reflected plane polarised light, oil immersion.

Fig.3.15. Photomicrograph of fusinised resin, recorded as macrinite (MA) from the Tirrawarra Formation; x 300.

Fig.3.16. Photomicrograph of macrinite (MA) from the Tirrawarra Formation; x 300.

Fig.3.17. Photomicrograph of micrinite (MI) filling cell lumens in vitrinite (V) from the Patchawarra Formation; x 300.

Fig.3.18. Photomicrograph of micrinite (MI) with exinite (E) from the Patchawarra Formation; x 300.

Fig.3.19. Photomicrograph of micrinite (MI) with inertodetrinite (I) from the Patchawarra Formation; x 300.

Fig.3.20. Photomicrograph of micrinite (MI) with clay (C) from the Patchawarra Formation; x 300.

All photomicrographs are in reflected plane polarised light, with oil immersion.

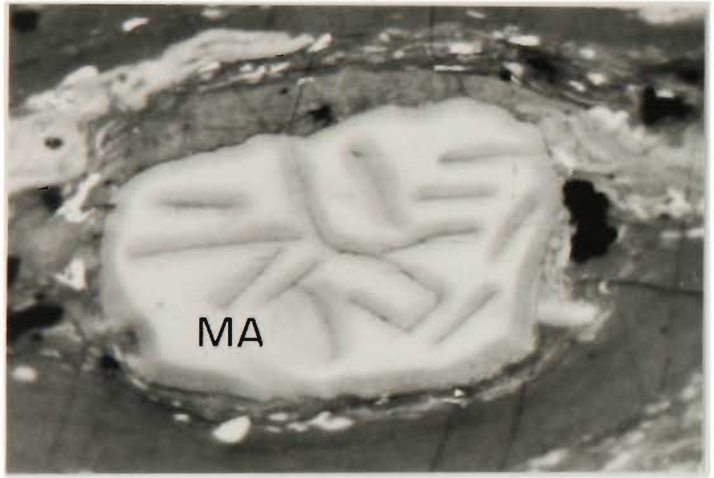


Fig. 3.15

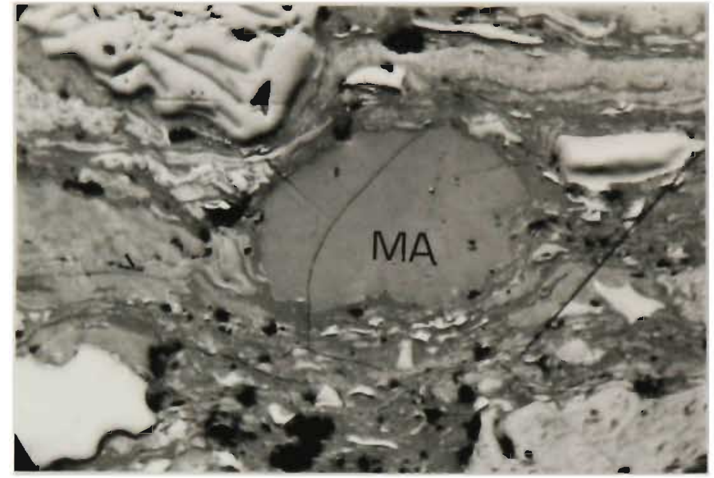


Fig. 3.16

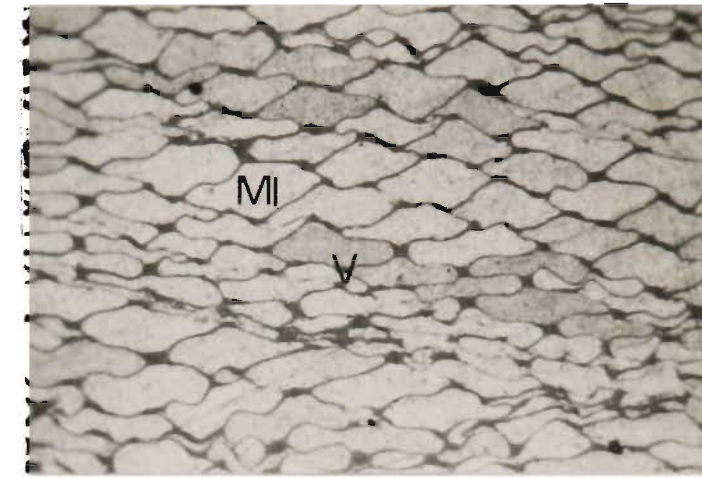


Fig. 3.17

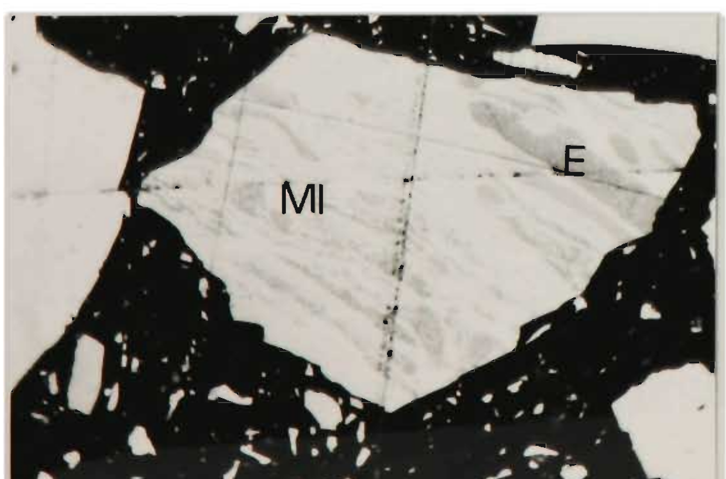


Fig. 3.18

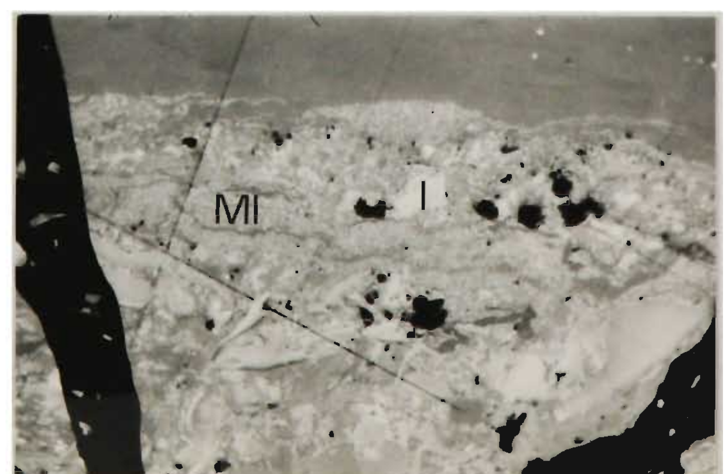


Fig. 3.19

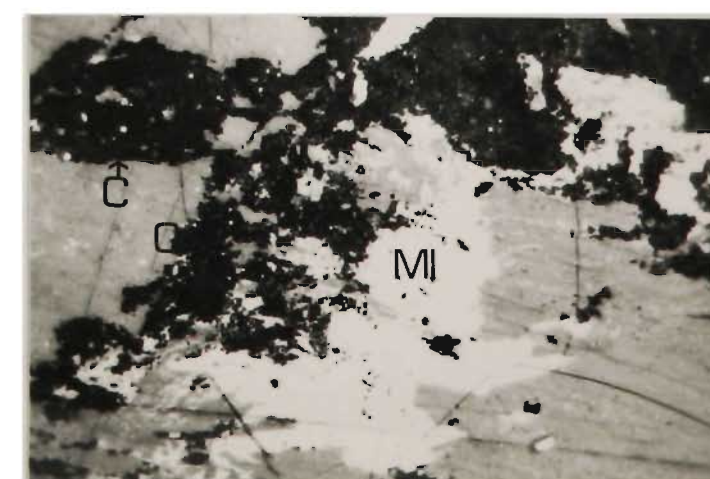


Fig. 3.20

These anisotropic lenses with no discernable botanical structures have been classified as groundmass macrinite (Figs. 3.11, 3.12, 3.13). Some of this macrinite has inclusions of other macerals in it, such as inertodetrinite as shown in Fig.3.14. The Cooper Basin coals have a high proportion of this material compared with Australian Permian coals from the Sydney and Bowen Basins.

Fusinized resin bodies also have been classified as macrinite (Fig.3.15), as have large structureless fragments with rounded corners (Fig.3.16). However, the "groundmass macrinite" makes up the bulk of the macrinite category.

Micrinite forms only a small percentage of the coals, generally less than 1%. It occurs filling cell lumens (Fig.3.17); associated with exinite (Fig.3.18); mixed with other inertinites (Fig.3.19); and associated with clay (Fig.3.20).

Vitrinite and exinite combined generally comprise less than half of the coal, with exinite less than 10%, and in many seams only 1-2%.

The exinite, mainly sporinite, is associated with vitrinite and inertodetrinite (Figs.3.21, 3.22). Cutinite is rare; generally it is associated with vitrinite in clarite (Fig.3.23). Alginite is rare in the coals, and is mostly associated with inertinite and some mineral matter (Figs.3.24, 3.25). Resinite is extremely rare.

Vitrinite is present in thin bands, less than 50 micrometres in vitrinertite, generally, rather than as wide bands of vitrite (Fig.3.26, 3.27).

The microlithotypes containing 5% and more of exinite:

clarite duroclarite clarodurite durite

are rare because of the low exinite content of the coals. The microlithotypes corresponding to the above, but without exinite:

vitrite vitrinertite inertite

far exceed the first group in volume.

Except for the Toolachee Formation, the Patchawarra Trough coals are Lower Permian. Australia was glaciated in the Late Carboniferous - Early Permian time (Schmidt and Embleton, 1981), (Fig.3.28). The coals probably formed from predominantly tundra and muskeg-type vegetation which was only preserved from complete oxidation by being frozen much of the time.

3. (iii) The petrography of the dispersed organic matter

Like the coals, the dispersed organic matter, or DOM (DOM is the abbreviation for dispersed organic matter used by McKirdy and Kantsler, 1980), is inertinite-rich. Inertodetrinite is present in even higher proportions in the DOM than in the coals. Minor quantities of semi-fusinite, fusinite and particulate macrinite are present as DOM also (Figs.3.29, 3.30, 3.31, 3.32).

As a general rule, the DOM contains less vitrinite and more exinite and/ or inertinite than the associated coals. Exinite DOM is mostly sporinite (Fig.3.30), with a little cutinite (Fig.3.33), and minor alginite (Figs. 3.29, 3.30).

The percentage of vitrinite DOM is low (Fig.3.29), perhaps because small fragments of the vitrinite precursor were readily oxidised to inertinite by transportation to a shale or siltstone.

The DOM is concentrated in the finer grained sediments, mostly shales and some siltstones. Sandstones contain very little DOM.

3. (iv) The Fly Lake - Brolga area

The stratigraphy in the Fly Lake - Brolga area of the Cooper Basin

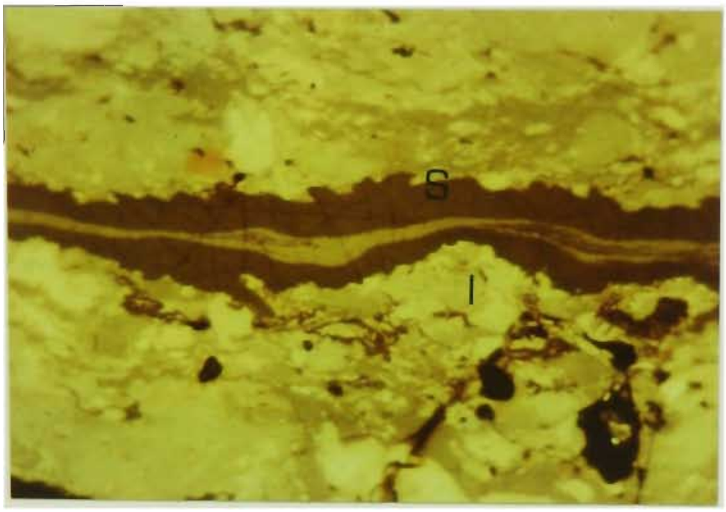


Fig. 3.22

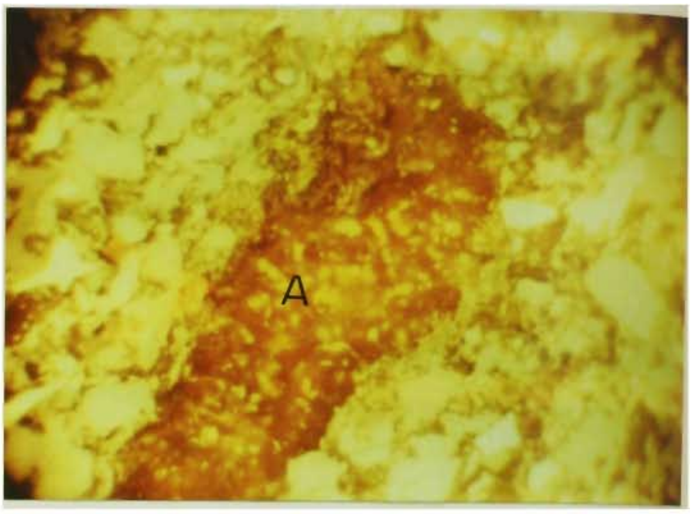


Fig. 3.24

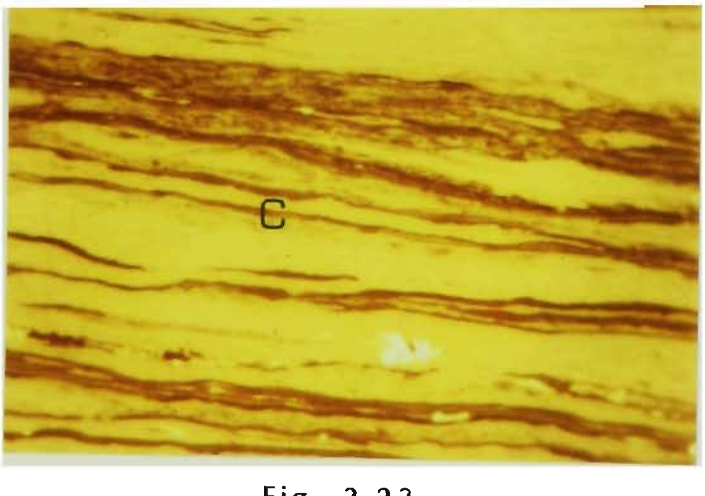


Fig. 3.23

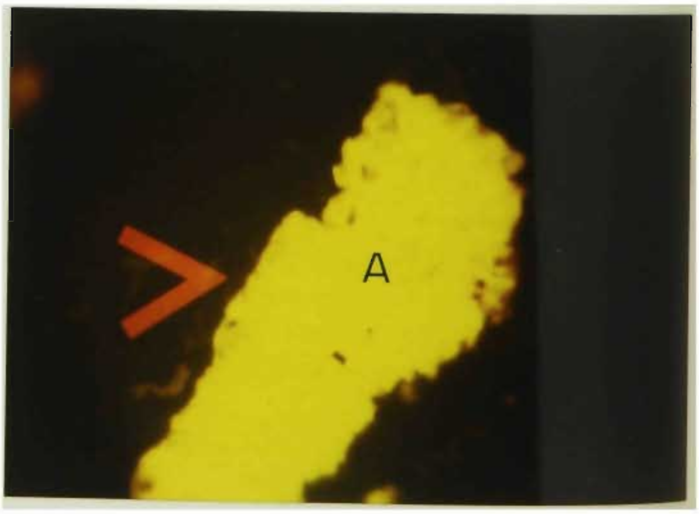


Fig. 3.25

Fig.3.22. Photomicrograph of sporinite (S) with inertinite (I) from the Patchawarra Formation; x 335, plane polarised light.

Fig.3.23. Photomicrograph of cutinite (C) in vitrinite (V) from the Patchawarra Formation; x 335, plane polarised light.

Fig.3.24. Algal body (A) in coal from the Toolachee Formation; x 335, plane polarised light.

Fig.3.25. Same as above, but in fluorescence mode and unpolarised light; x 335.

All photomicrographs are taken using oil immersion and reflected light.

Fig.3.21. Photomicrograph of sporinite (S) in vitrinite (V) from the Patchawarra Formation; x 420.

Fig.3.26. Photomicrograph of thin vitrinite bands (V) with inertinite (I) to give the microlithotype vitrinertite, from the Patchawarra Formation; x 420.

Fig.3.27. Photomicrograph of vitrinertite, mostly inertinite (I) with thin bands of vitrinite (V) from the Patchawarra Formation; x 420.

All photomicrographs are in reflected plane polarised light, with oil immersion.

Fig. 3.21

Fig. 3.26

Fig. 3.27

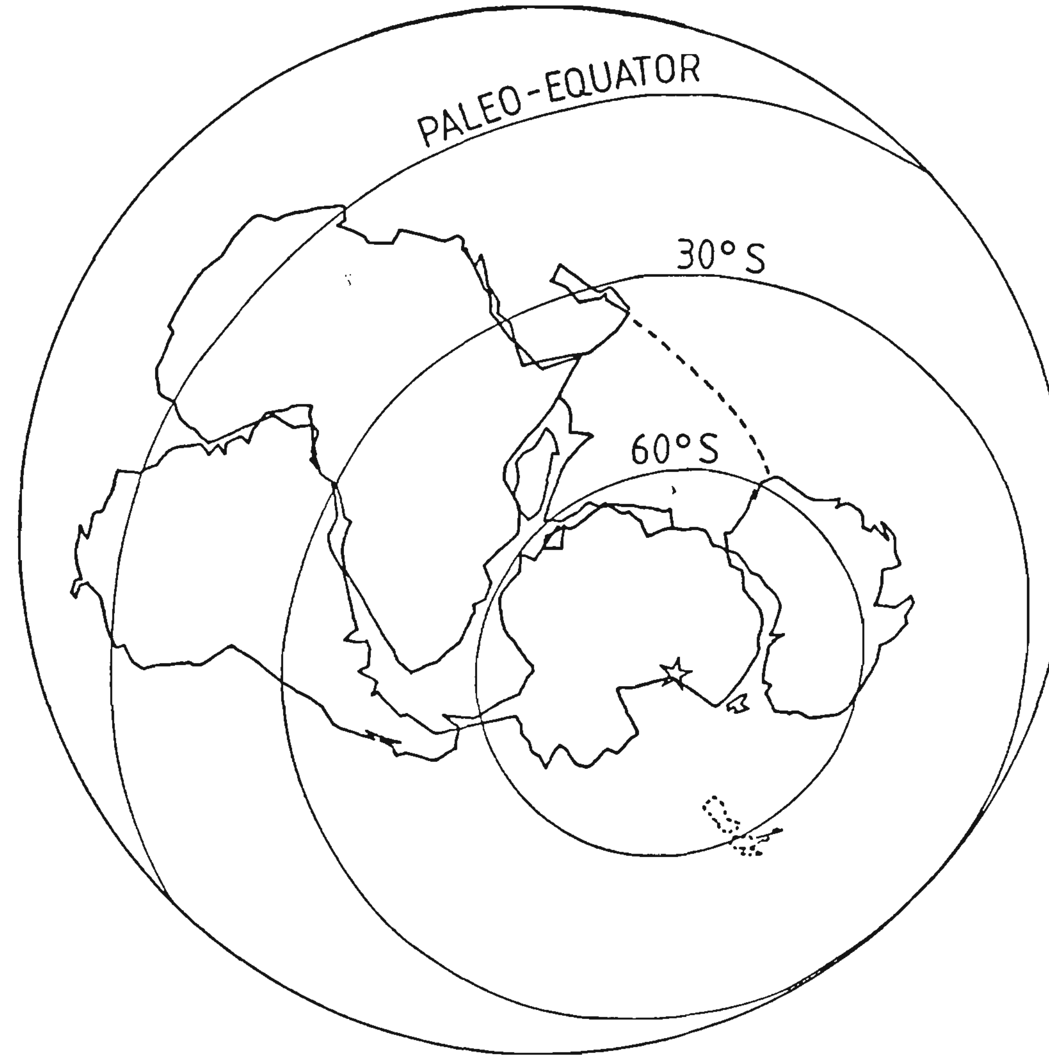


FIG. 3.28

Geographical location of Australia
in the Permian. (After Schmidt and Embleton, 1981)

Fig.29.(a) Photomicrograph of alginite (A) dispersed organic matter (DOM) in sediment from the Patchawarra Formation; x 335. Unpolarised light.

(b) Same field as above in fluorescence mode, alginite fluorescing yellow.

Fig.30.(a) Photomicrograph of DOM in a sediment from the Patchawarra Formation: A = alginite, S = sporinite, I = inertodetrinite; x 335. Unpolarised light.

(b) Same field as above in fluorescence mode, alginite and sporinite fluorescing yellow.

All photomicrgraphs are in reflected light, with oil immersion.

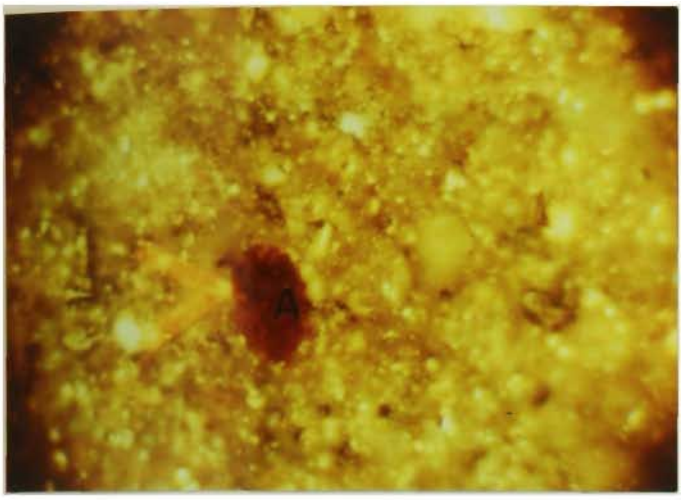


Fig. 29(a)

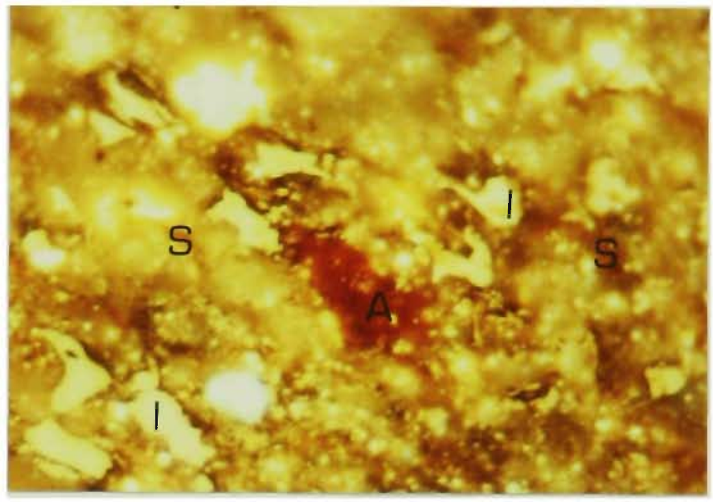


Fig. 3.30(a)

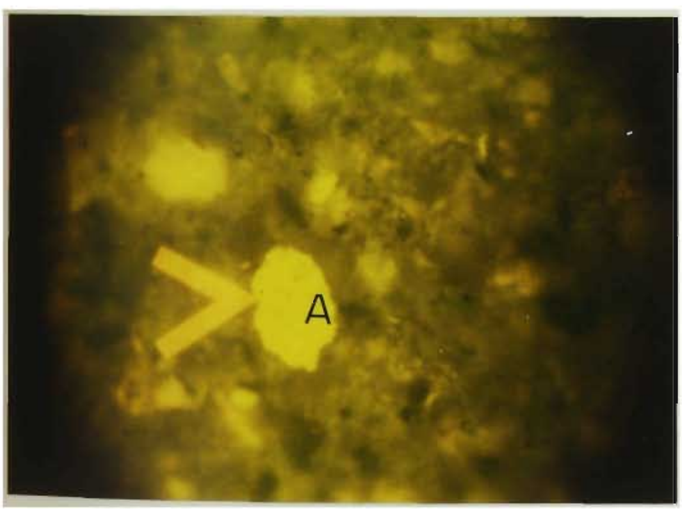


Fig. 29(b)

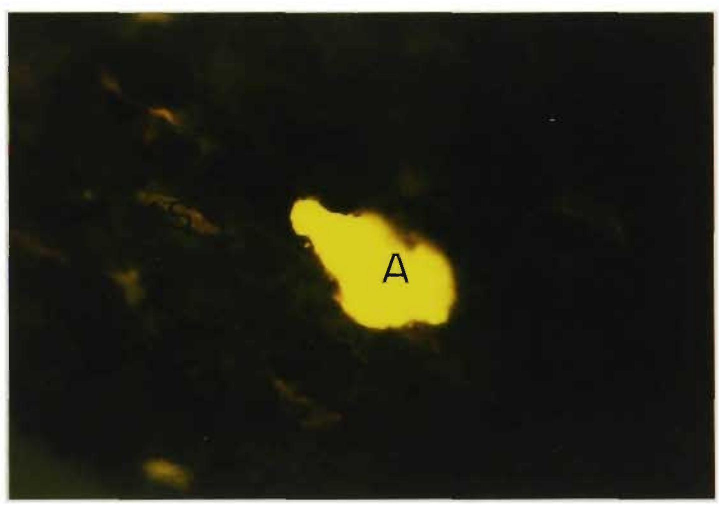


Fig. 3.30(b)

(Fig.1.) is given in Fig.3.34 (after Battersby, 1976), which also shows the locations of the 4 wells drilled in this area: Fly Lake 1 to 3 and Brolga 1. The depths at which the rocks were sampled are indicated on Figs.3.35 to 3.38.

In this area of the Cooper Basin, the reflectance of vitrinite in coals near the top of the Patchawarra Formation (Fig.1.2) is approximately 0.80% ($\bar{R}_o$ max), and at the base is approximately 1.00 to 1.10%. At this rank exinite is translucent, vitrinite is translucent to opaque, depending on the thickness of the thin section and the depth of the sample; and inertinite is opaque.

Descriptions of the results of the transmitted light and reflected light, fluorescence mode examinations are given in Appendices 3.1 to 3.4 and the information is summarized in Tables 3.1 to 3.4 (these tables are in the appendix also).

The number of samples examined is:

Fly Lake 1	18	
Fly Lake 2	22	
Fly Lake 3	52	
Brolga 1	38	
	130	total

The composition of the translucent DOM can be assessed by combining information gathered for each sample using both transmitted light and the fluorescence mode. In a sample with a relatively high proportion of translucent DOM (transmitted light) but a low volume of exinite fluoresc-ence mode), most of the translucent material must be vitrinite. The exinite content of these samples is typically low.

The number of coal samples which were analysed for their maceral and

Fig.3.31. Dispersed organic matter, semifusinite (SF), in a a sediment from the Patchawarra Formation; x 465.

Fig.3.32. Large inertinite body, classified as particulate macrinite (Ma) from the Patchawarra Formation; x 465.

Photographs have been taken in plane polarised reflected light under oil immersion.

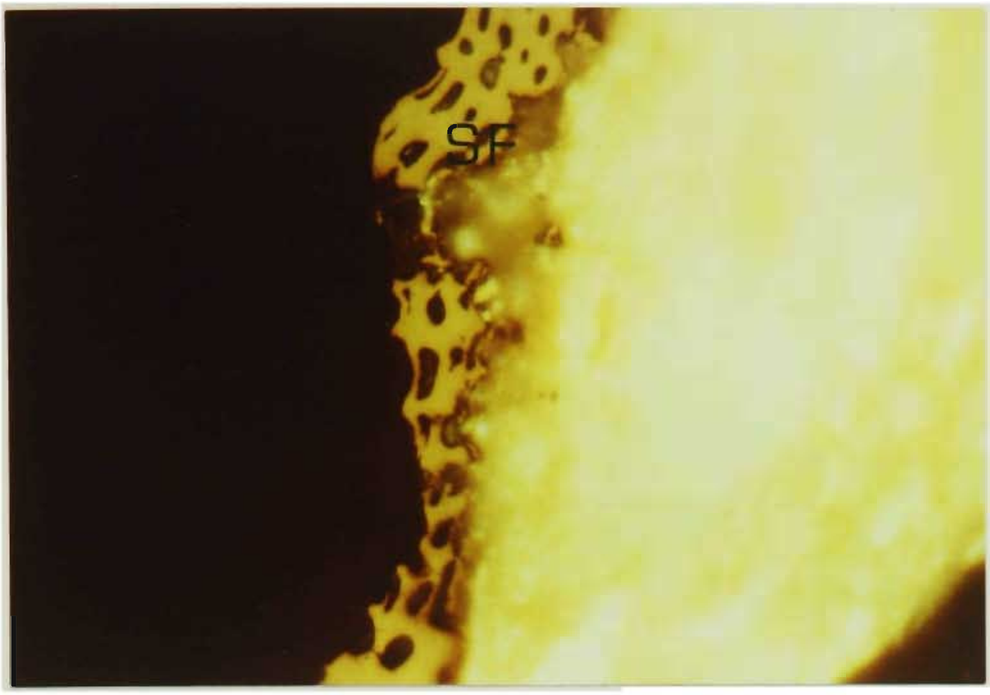


Fig. 3.31

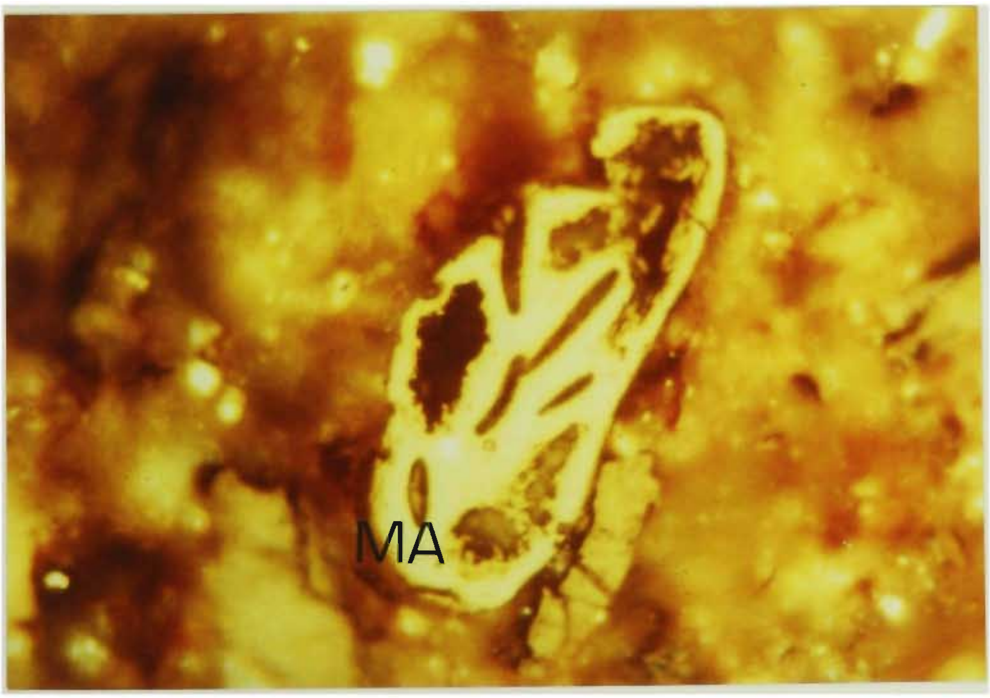


Fig. 3.32

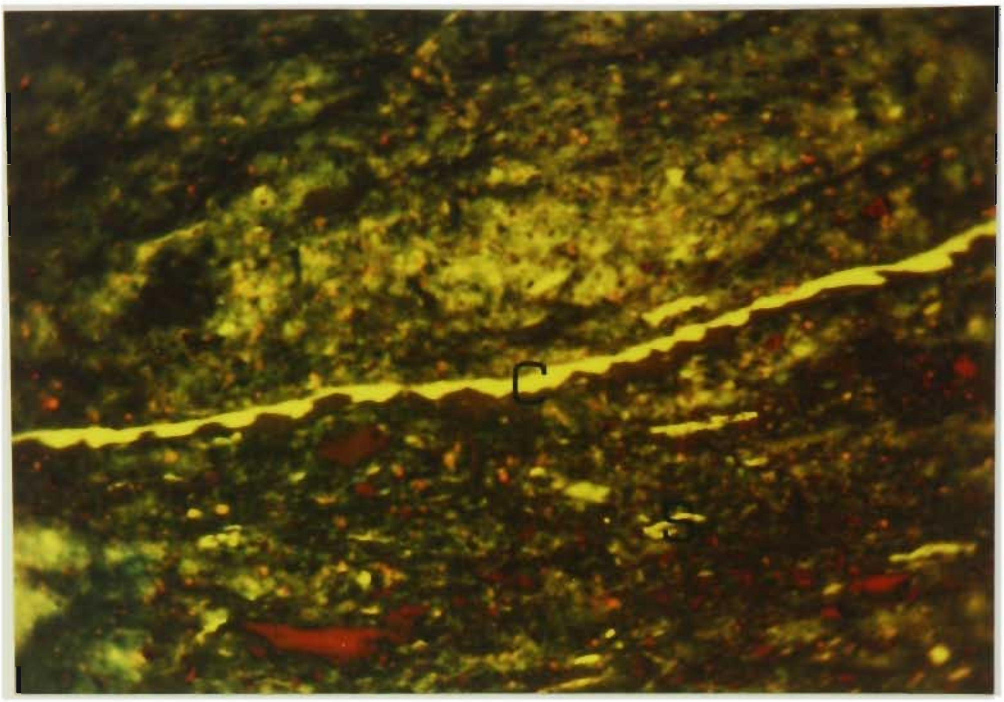


Fig. 3.33

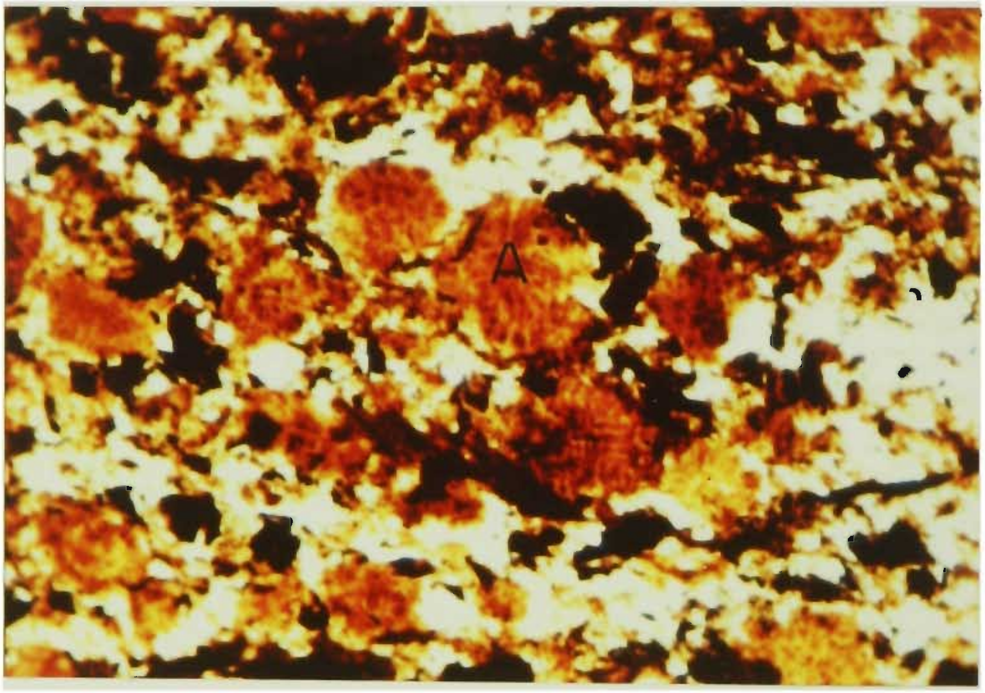


Fig. 3.41(a)

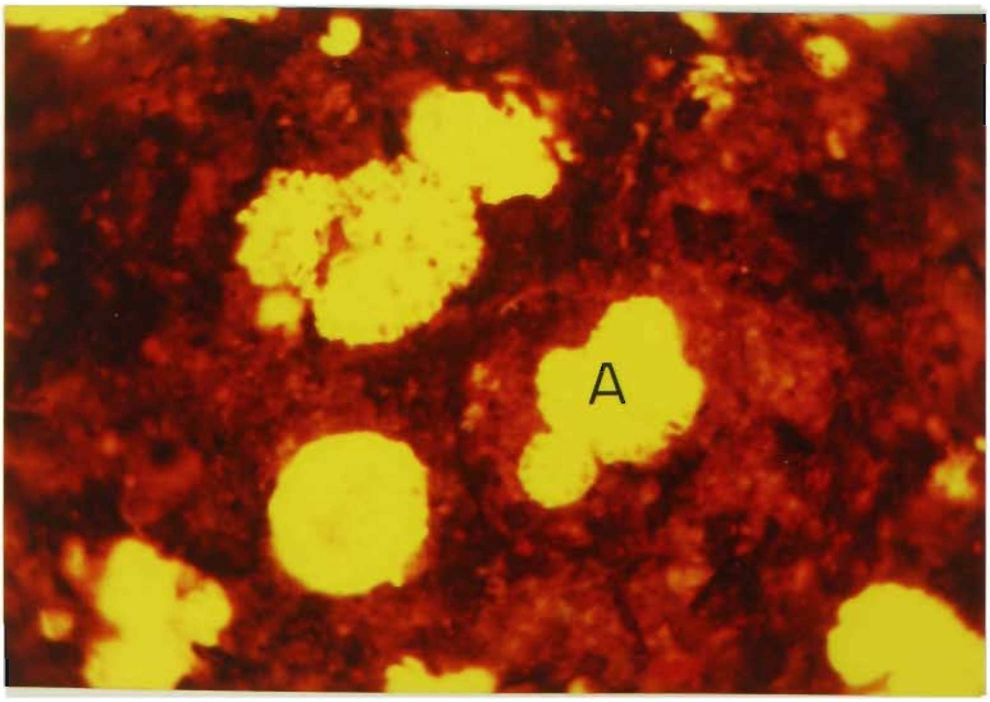


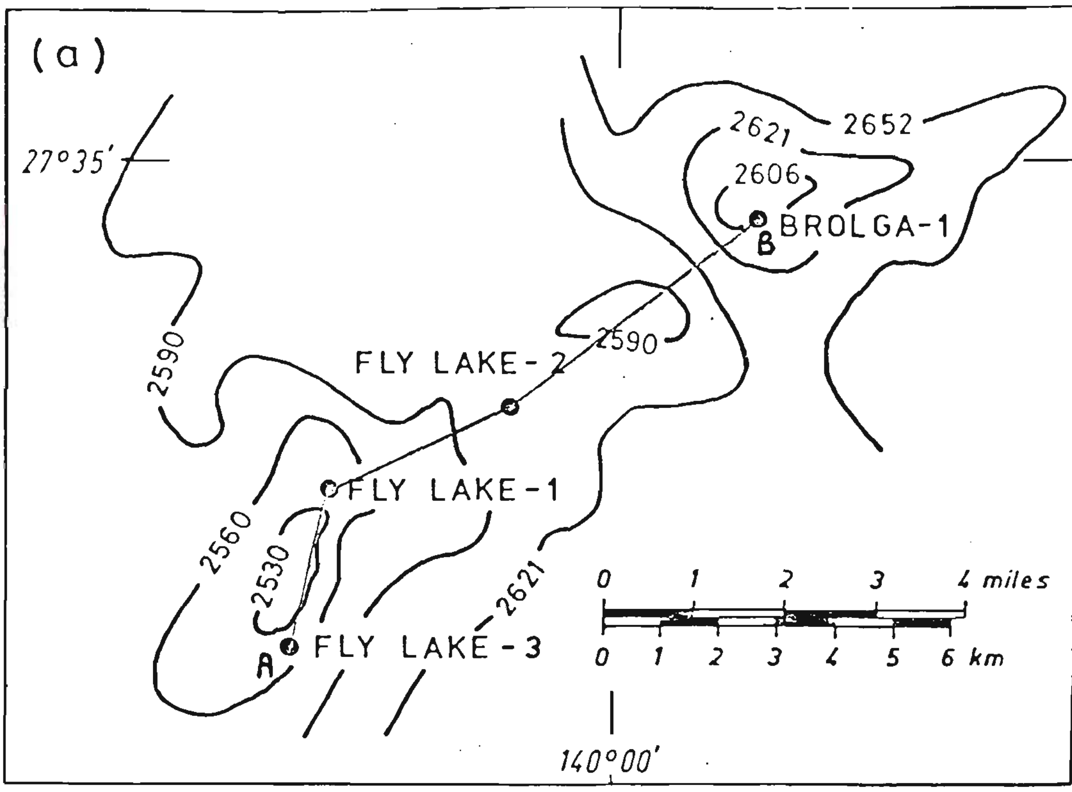
Fig. 3.41(b)

Fig.3.33. Cutinite (C) in a sedimentary rock from the Patchawarra Formation, using reflected light, fluorescence mode; x 465.

Fig.41.(a) Photomicrograph of alginite (A) from the algal-rich layer at the top of Stage 3' of the Patchawarra Formation, Brolga 1 well; x 465. Transmitted light.

(b) Similar field to above in fluorescence mode, alginite fluorescing yellow.

Fig. 3. 34a : Locations of the four wells in the Fly Lake - Brolga area, Cooper Basin.



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(b

Fig. 3. 34b : Structural cross-section of the Fly Lake - Brolga area (From Battersby, 1976)

microlithotype contents is:

Fly Lake 1	108	
Fly Lake 2	43	
Fly Lake 3	42	
Brolga 1	26	
	219	total

Neither the samples of the inter seam rocks nor coal samples cover the Permian sequence evenly, because they are from cores only. Nevertheless, the large number of samples should indicate any preferred associations between the maceral compositions of the DOM and the petrographic compositions of the associated coals.

Results of the maceral analyses are given in Tables 3.5 to 3.8 and plotted in Fig.3.39; those for the microlithotypes are in Tables 3.9 to 3.12 (in Appendix) and Fig.3.40. An extremely inertinite-rich and very thick seam in Fly Lake 1 has been named the Malabine Coal. Details are in Appendix 3.5.

3. (v) Discussion of results

The subdivisions used by Thornton (1979) in his palaeogeographical reconstructions of the Gidgealpa Group are shown in Table 2.1. The Fly Lake 1 samples are from Stage 3' of the Patchawarra Formation and from the Toolachee Formation. The coals are rich in inertinite and inertite: the DOM in the associated sedimentary rocks is largely inertinite (Figs.3.35, 3.39, 3.40). The sandstone to shale ratio for Stage 3' is less than 1; for the Toolachee Formation it is more than 1 (Thornton, 1979, Table 3.13).

The Tirrawarra Formation and Stage 3' and Upper Stage 4' of the Patcha-warra Formation were sampled in Fly Lake 2. The Upper Stage 4' coals

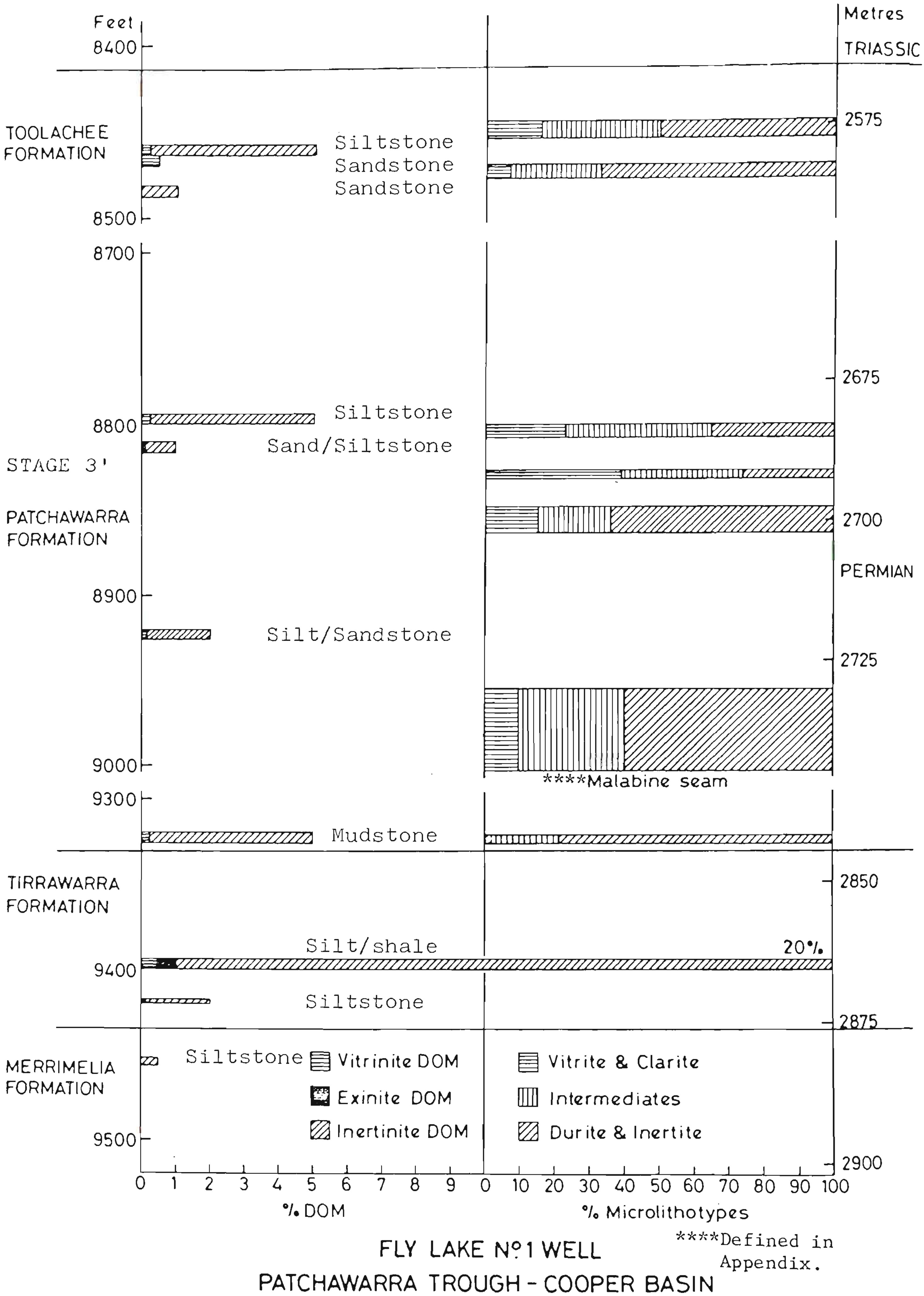
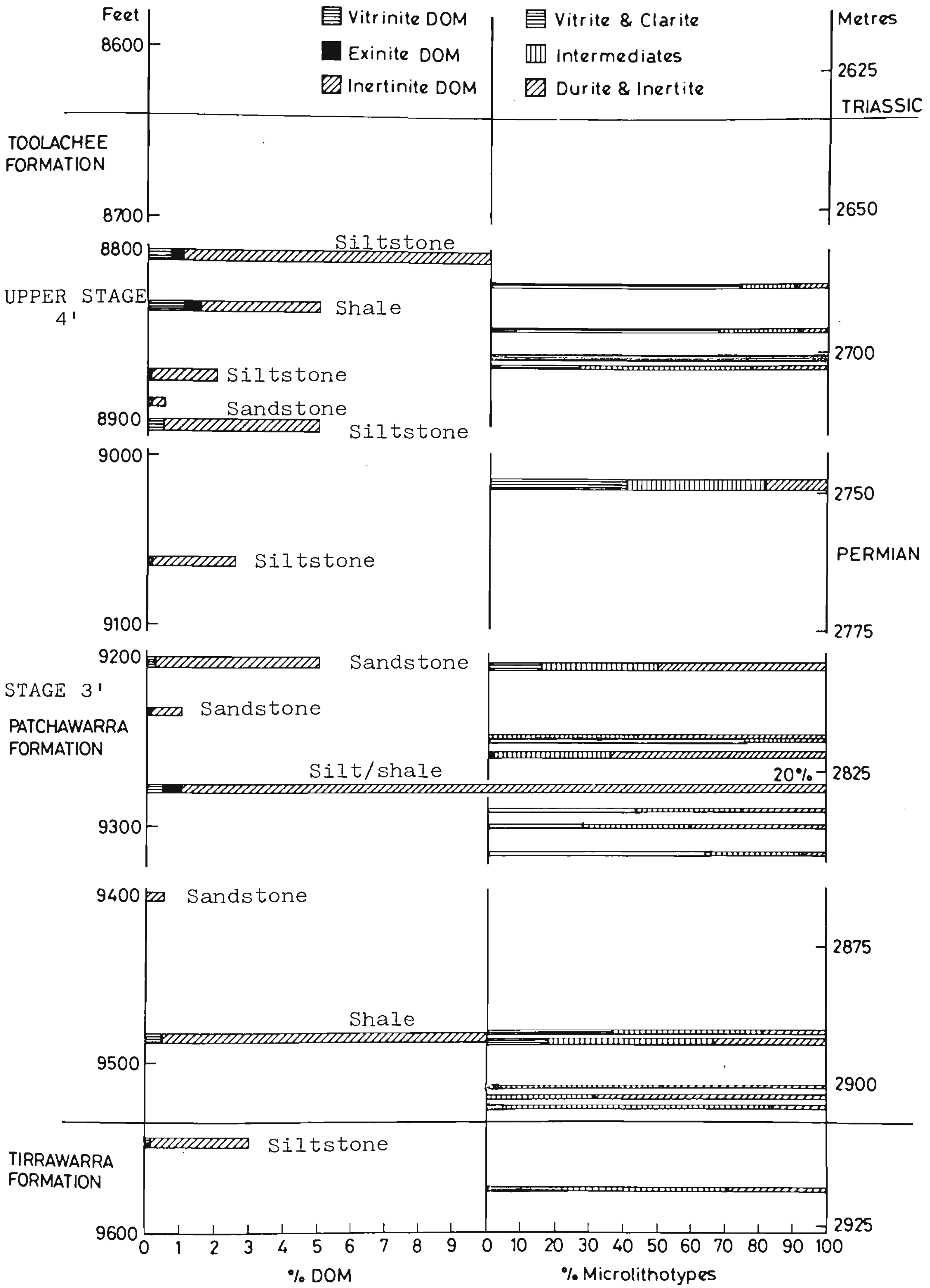


Fig. 3.35: Comparison of the quantities and types of DOM with the petrography of associated coals.



FLY LAKE Nº 2 WELL

PATCHAWARRA TROUGH - COOPER BASIN

Fig. 3.36 : Comparison of the quantities and types of DOM with the petrography of associated coals.

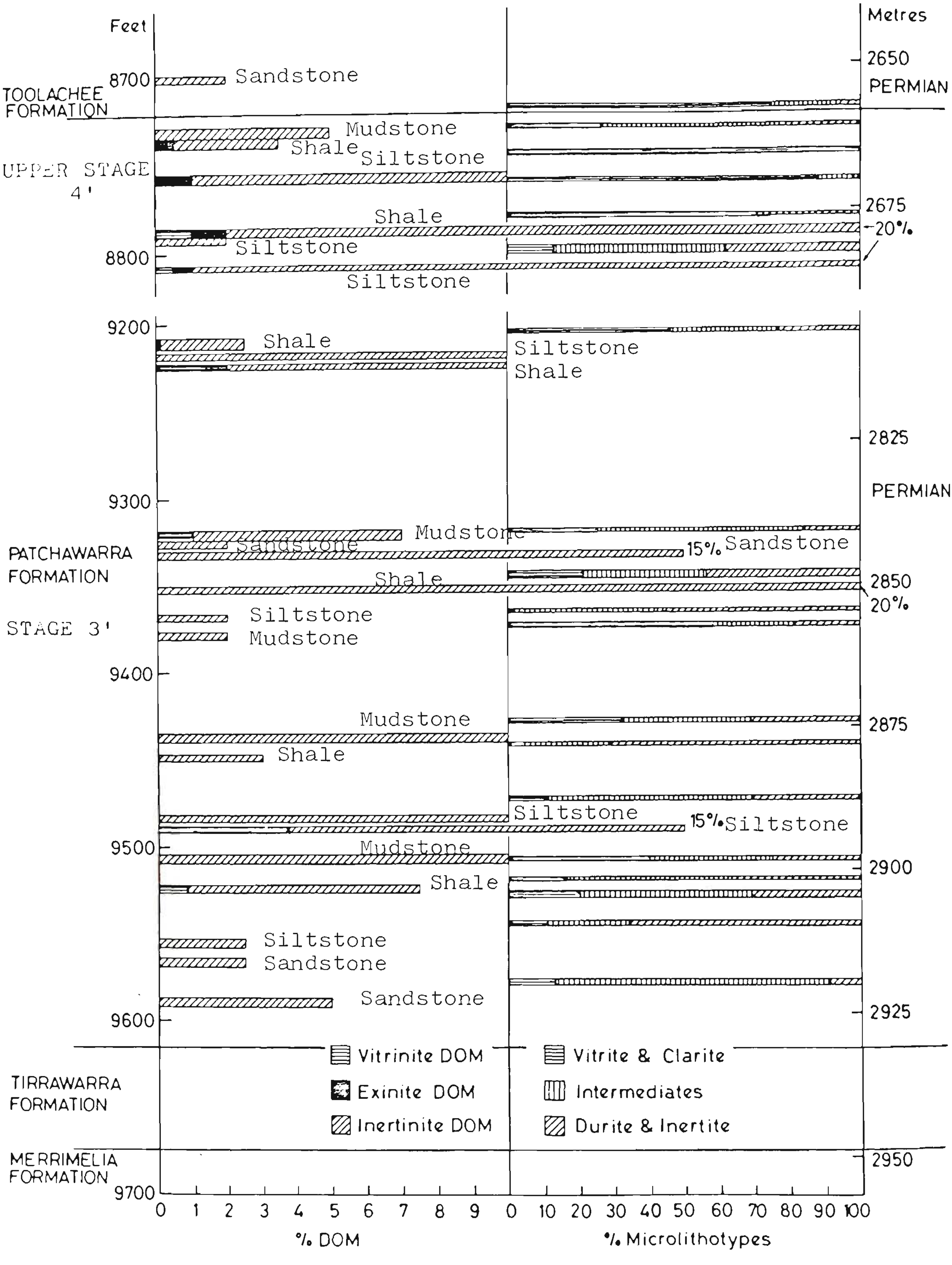


Fig. 3.37 : Comparison of the quantities and types of DOM with the petrography of associated coals.

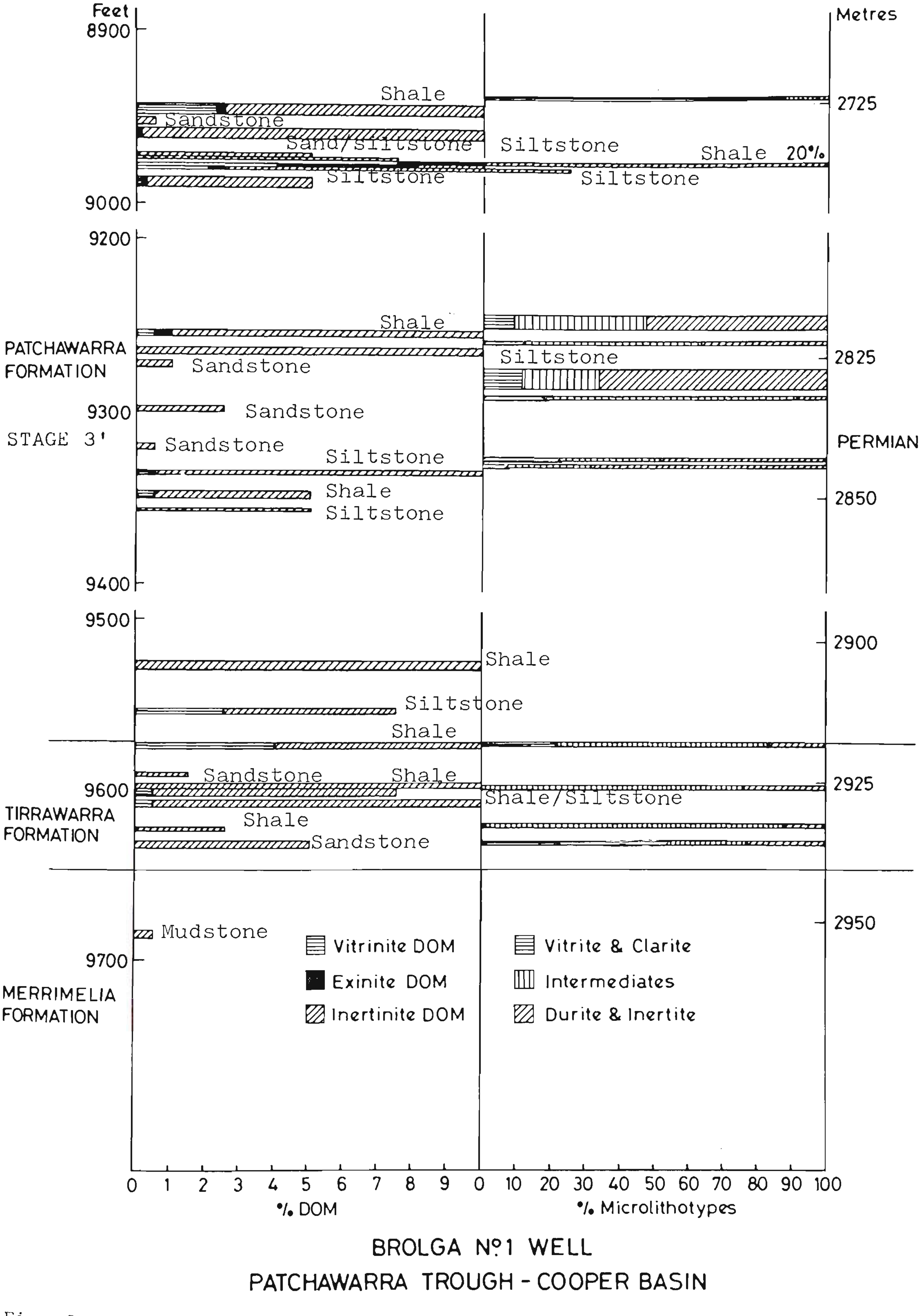


Fig. 3.38: Comparison of the quantities and types of DOM with the petrography of associated coals.

are rich in vitrite plus clarite; those in Stage 3' and the Tirrawarra Formation are richer in inertite and intermediate microlithotypes (vitrinertite, duroclarite, clarodurite). The DOM in the associated sedimentary rocks is inertinite-rich, with occurrences of small proportions of vitrinite and exinite, particularly in Upper Stage 4' (Figs.3.36, 3.39, 3.40). The sandstone to shale ratio of Stage 3' is more than 1; of Upper Stage 4' is less than 1 (Table 3.13). In the Tirrawarra Formation, which is dominated by sandstone, the ratio is much more than 1.

Samples were taken from Stage 3' and Upper Stage 4' of the Patchawarra Formation and from the Toolachee Formation in Fly Lake 3. The coals and DOM are similar to those in Fly Lake 2. Coals rich in vitrite plus clarite and the highest proportion of exinite DOM occur in Upper Stage 4'. The one coal sampled from the Toolachee Formation is rich in vitrite plus clarite, unlike the inertite-rich coal from the Toolachee Formation in Fly Lake 1 (Figs.3.37, 3.39, 3.40). The sandstone to shale ratio is more than 1 for Stage 3' and the Toolachee Formation: it is less than 1 for Upper Stage 4' (Table 3.13).

Stage 3' of the Patchawarra Formation and the Tirrawarra Formation were sampled in Brolga 1. Most coals in Stage 3' have high inertite plus durite contents: one coal near the top of Stage 3' has a high vitrite plus clarite content. In the Tirrawarra Formation the coals are rich in intermediate microlithotypes. The DOM in the associated sedimentary rocks is inertinite-rich, with the highest proportions of exinite near the top of Stage 3', including an alginite-rich layer (Figs.3.38, 3.39, 3.40, 3.41). The sandstone to shale ratio in Stage 3' is less than 1 (Table 3.13).

The above data show that:

1. Inertinite-rich DOM occurs throughout the rocks studied and

Table 3.13 Sandstone to shale ratios (from Thornton (1979)) and dominant coal microlithotypes

Interval	Fly Lake 3	Fly Lake 1	Fly Lake 3	Brolga 1
Toolachee Formation	> 1 Vt + C (C)	> 1 It+Du (c) I (D)	> 1	> 1
Upper Stage 4'	< 1 Vt + C (C) E (D)	< 1	< 1 Vt +C (C) V+E (D)	< 1
Lower Stage 4	< 1	< 1	> 1	> 1 Vt+Cl (C) E (D)
Stage 3'	> 1 In, It+Du (C) I (D)	< 1 It+Du (C) I (D)	> 1 In, It+Du (C) I (D)	< 1 It+Du (C) I (D)
Tirrawarra Formation	>> 1	>> 1	>> 1 In, It+Du (C) I (D)	>> 1 In (C) I (D)

Predominant organic matter types are shown for each formation in the four wells

V = vitrinite
E = exinite
I = inertinite

Vt + Cl = vitrite + clarite
In = intermediates
It + Du = inertite + durite

C = coal
D = DOM

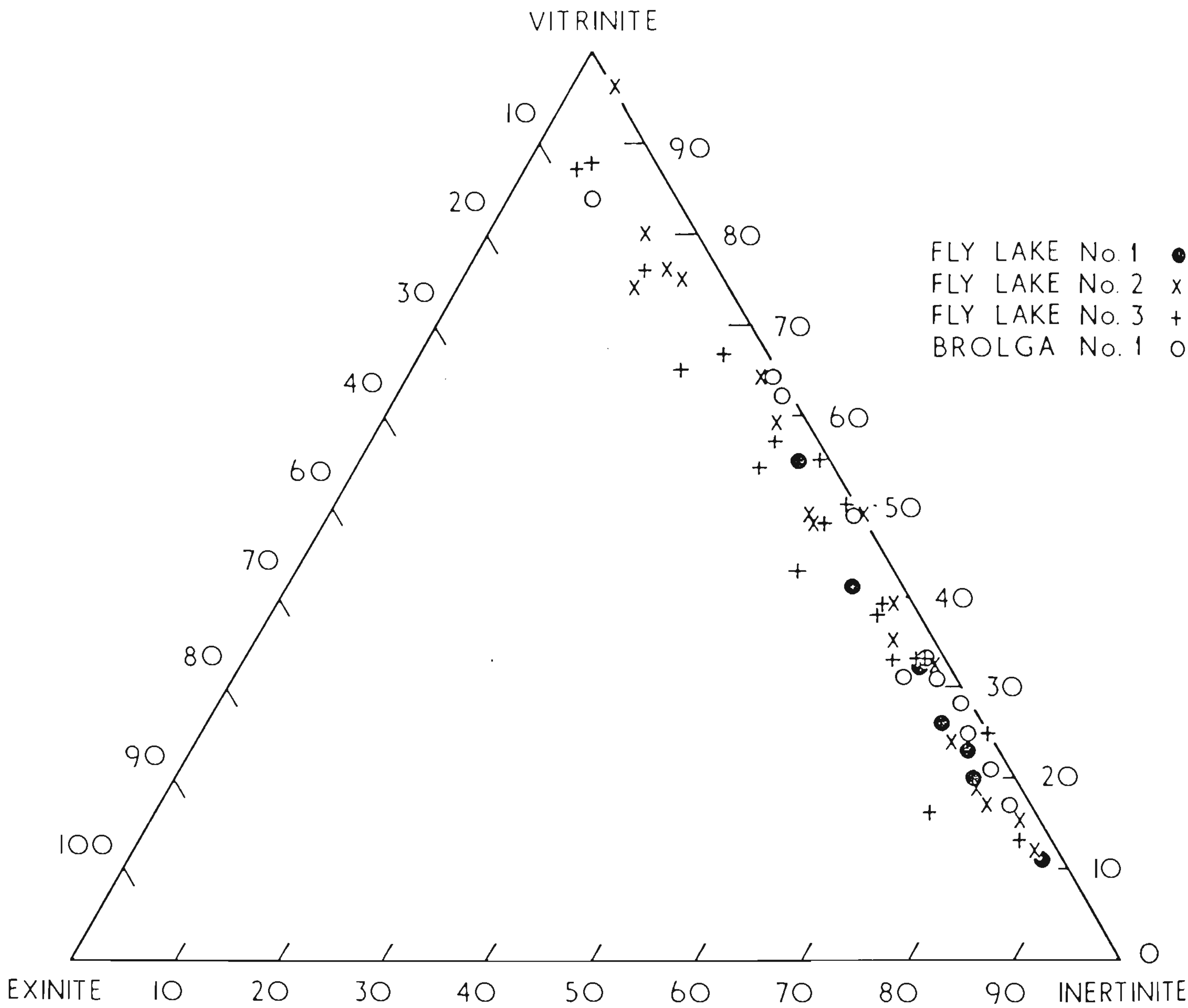


Fig. 3.39: Maceral compositions of coals from the Fly Lake - Brolga area of the Cooper Basin.

inertinite is the major component of the DOM;

2. coals rich in intermediate microlithotypes (> 60%) are most abundant in the Tirrawarra Formation and the base of the Patchawarra Formation;
3. coals relatively rich in vitrite plus clarite occur most commonly in Upper Stage 4' of the Patchawarra Formation; and
4. DOM with the highest proportions of exinite occurs in Upper Stage 4' and near the top of Stage 3' of the Patchawarra Formation.

3. (vi) Summary

DOM in the Permian sequence in the Fly Lake - Brolga wells is inertinite-rich. The highest proportion of exinite DOM occurs in Upper Stage 4' of the Patchawarra Formation, and to a lesser extent in the upper part of Stage 3'.

Coals are predominantly poor in vitrite plus clarite, high in intermediates and/or inertite plus durite. Vitrite plus clarite-rich coals occur most commonly in Upper Stage 4' of the Patchawarra Formation.

It is possible that a positive relationship exists between vitrite plus clarite-rich coals and the abundance of exinite DOM.

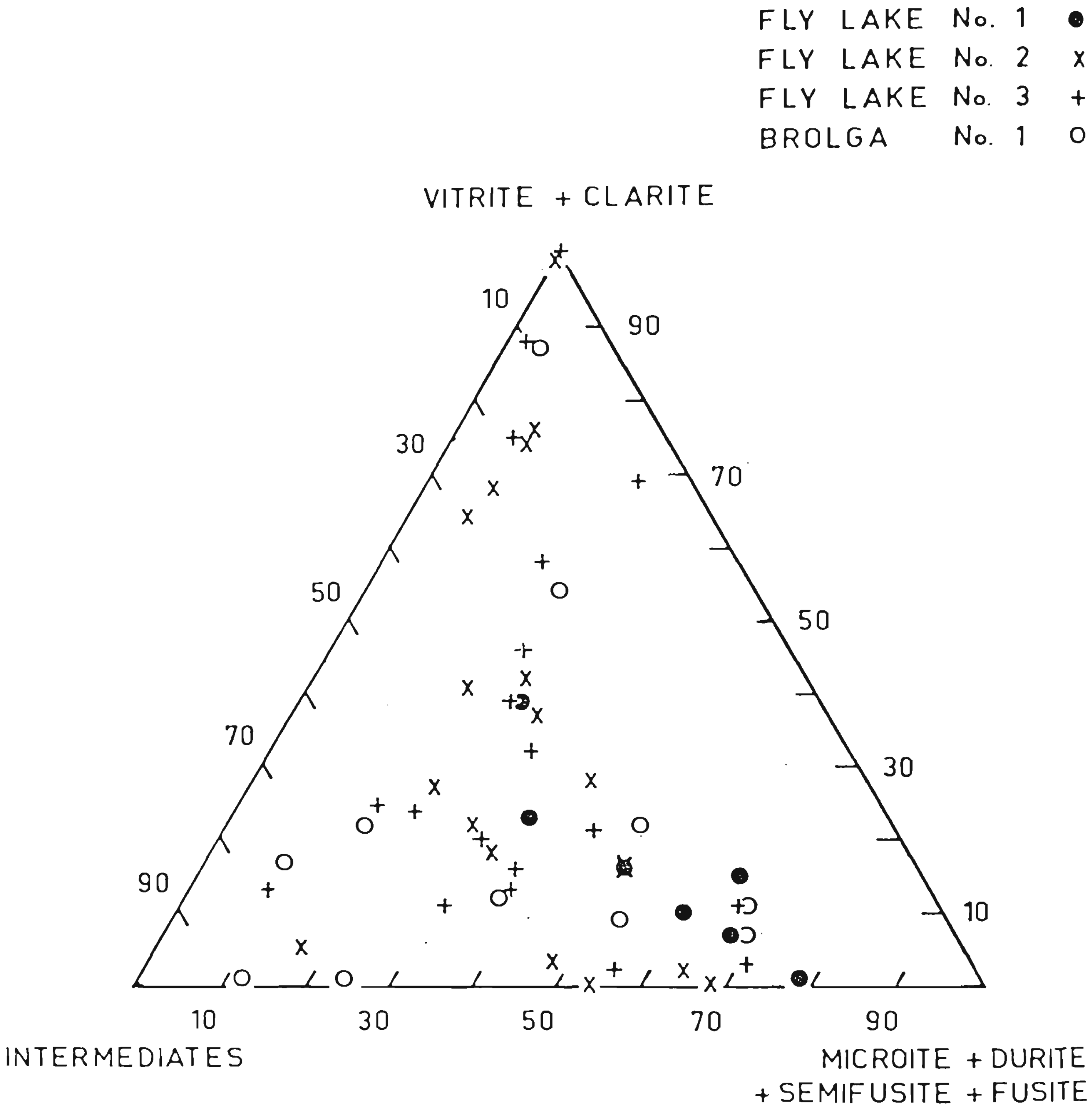


Fig. 3.40: Microlithotype compositions of coals from the Fly Lake - Brolga area of the Cooper Basin.
The proportion of clarite and durite is very small.
Intermediates are predominantely vitrinertite.

4. ORGANIC PETROLOGY OF SEDIMENTARY ROCKS FROM MUDRANGIE 1 AND TINDILPIE 1 WELLS, PATCHAWARRA TROUGH

4. (i) Introduction

The assessment of coals and DOM in associated rocks from the Fly Lake - Brolga area suggests that a relationship may exist between exinite DOM and coals with the highest vitrite plus clarite contents. This apparent relationship could be restricted to the Patchawarra Formation in the Fly Lake - Brolga area or may be more general.

To determine whether the above relationship occurs elsewhere in the Patchawarra Trough, petrographic analyses of the organic matter, coals and DOM, in two other wells, Mudrangie 1 and Tindilpie 1, were carried out (Fig. 4.1). Vitrinite reflectance in the Lower Permian of Tindilpie 1 is 1.30% $\bar{R}_o$max (Kantsler et al., 1978) and in Mudrangie 1 is approximately 1.00% $\bar{R}_o$max (Kantsler et al., 1983).

The samples from the Fly Lake - Brolga area, being cores, did not give a full coverage of the sediments in the wells. To lessen this problem, cuttings were chosen for the study of the organic matter in Mudrangie 1 and Tindilpie 1. This allowed selection of samples over much more of the sequence. Disadvantages, such as contamination, are minimised if a large number of cuttings are used.

4. (ii) Petrographic Analyses

Cuttings of 3m intervals through the two wells containing coal fragments and/or dark shales were selected for microscopic study. The cuttings were prepared as polished grain mounts and the maceral compositions of both coals and DOM were determined independently. Where a sample contained $\geqslant$ 5% coal, a microlithotype analysis was also carried out. Analyses were made in accordance with the recommendations of the International Committee for Coal Petrology (1963, 1971, 1975).

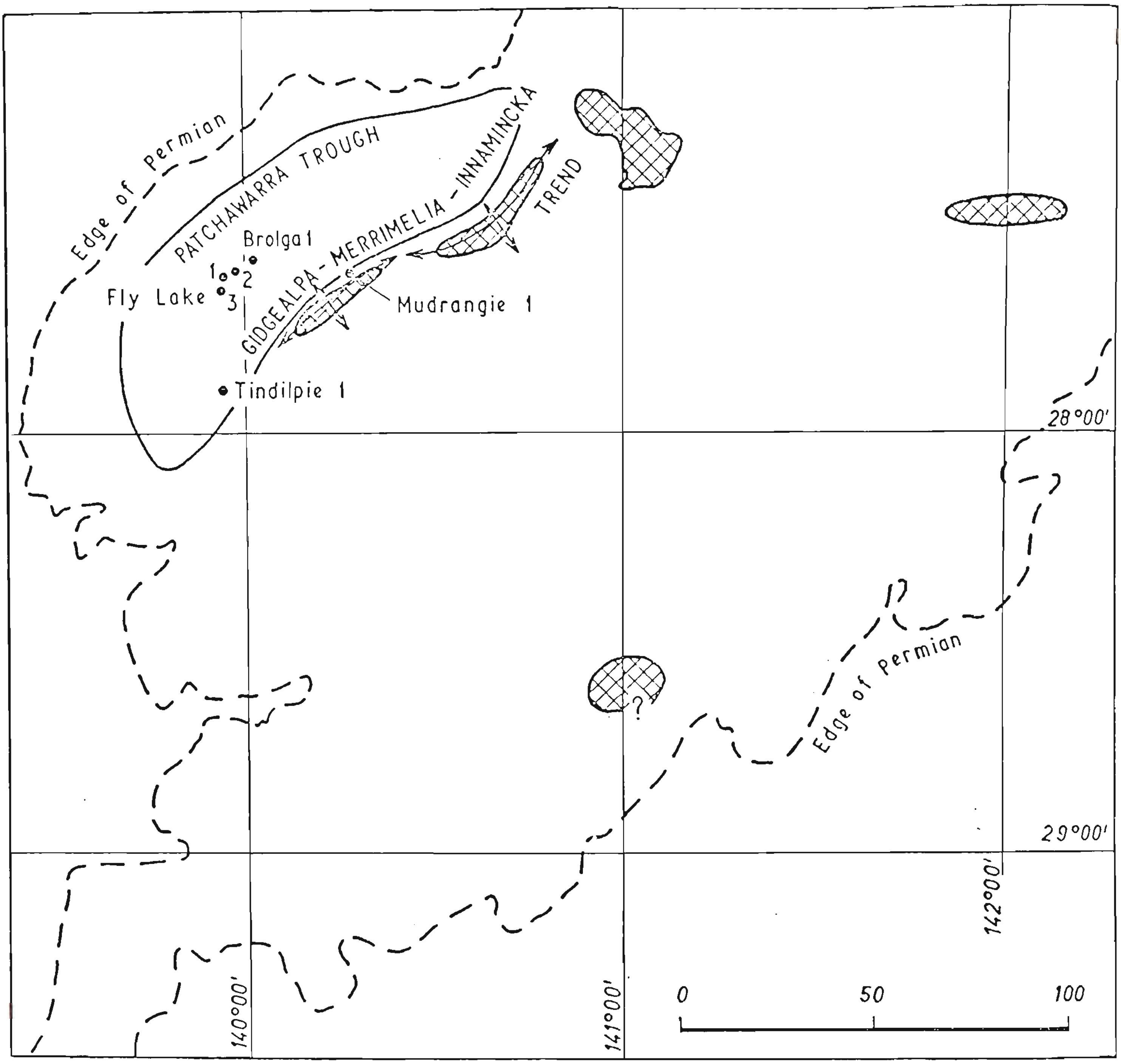


FIG. 4·1 PLAN OF THE SOUTHERN COOPER BASIN, SHOWING THE LOCALITIES OF THE FLY LAKE, BROLGA, MUDRANGIE AND TINDILPIE WELLS IN THE PATCHAWARRA TROUGH (AFTER THORNTON, 1979)

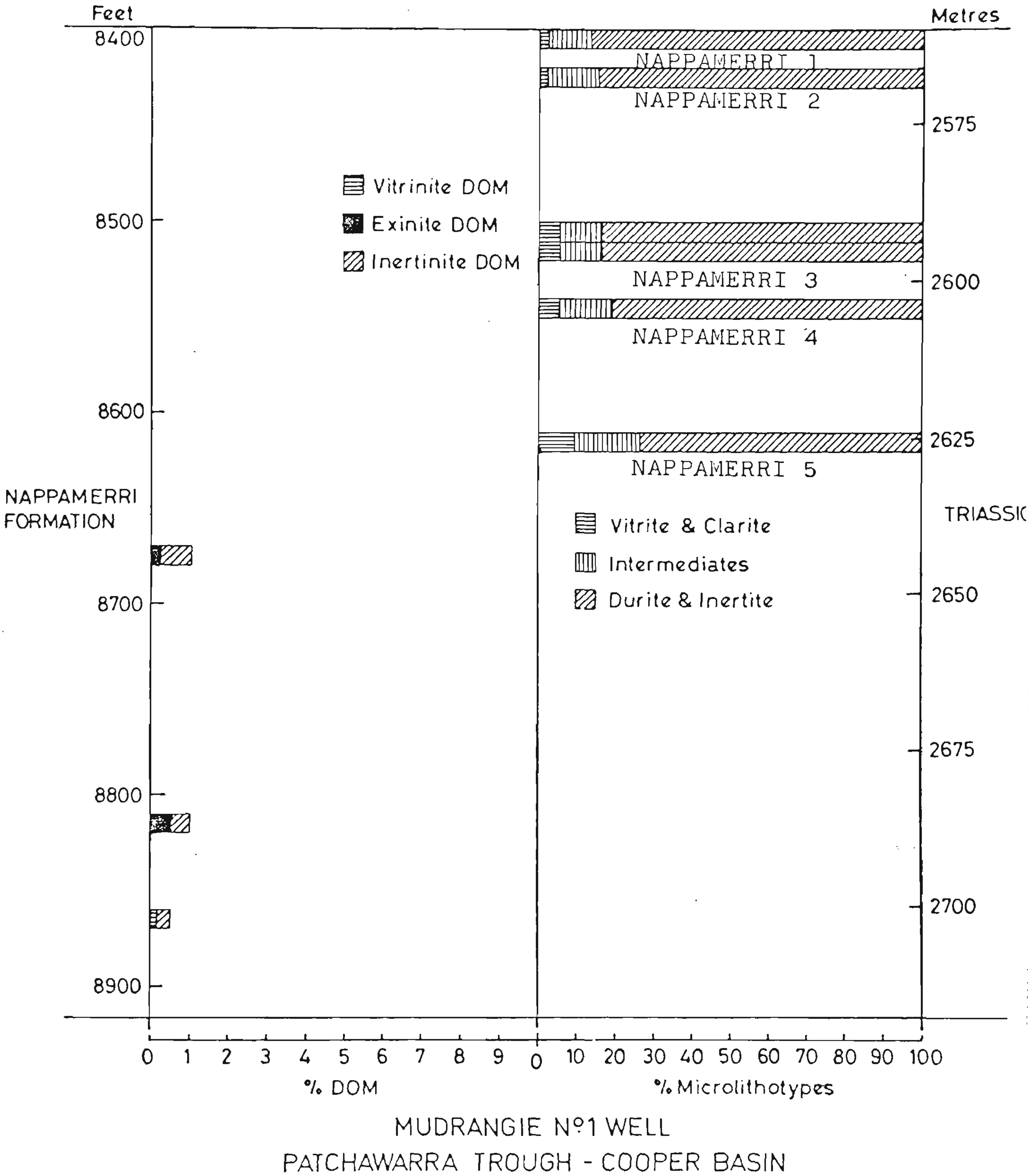


Fig. 4.2 : Compositions of DOM and coals in the Nappamerri Formation.

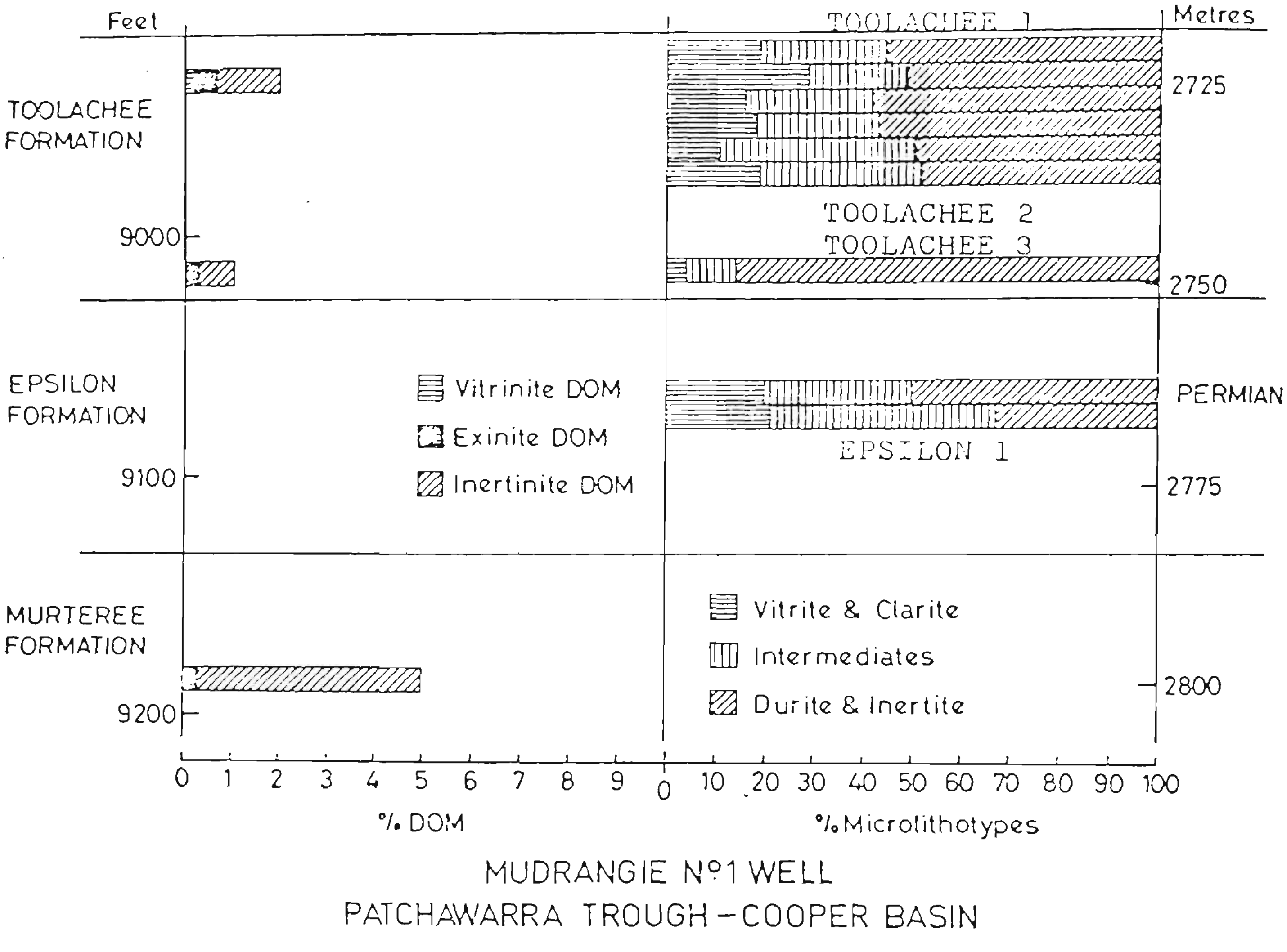


Fig. 4.3 : Compositions of DOM and coals in the Toolachee, Epsilon and Murteree Formations.

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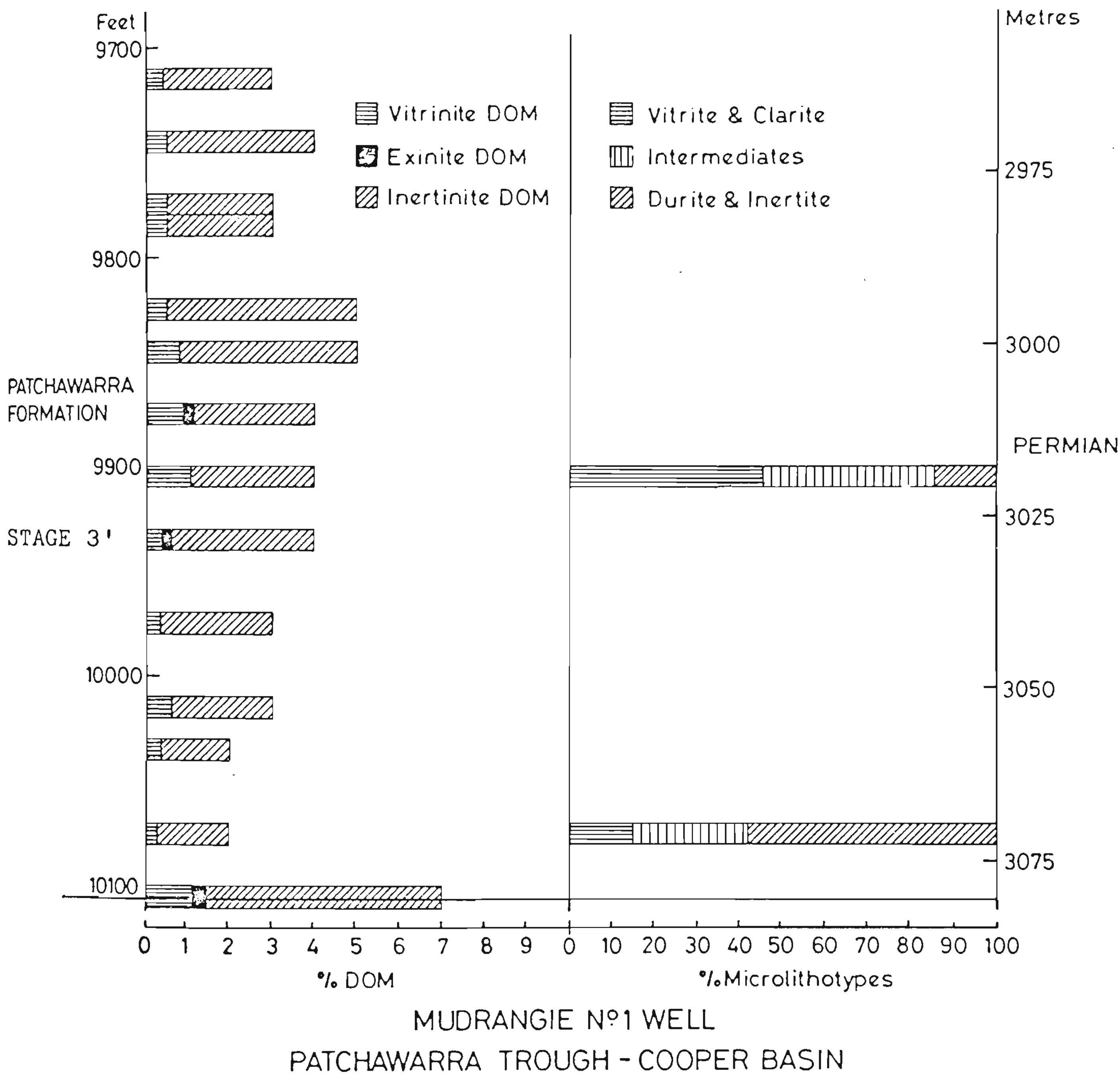


Fig. 4.5 : Compositions of DOM and coals from the Patchwarra Formation.

4. (iii) Mudrangie 1

Samples from Mudrangie 1 cover the interval 2560.3 m (8400 ft) to 3179.1 m (10430 ft). The sampling points are indicated on Figs.4.2 to 4.6, and are from the Triassic Nappamerri Formation (Fig.4.2) to the Permian Tirrawarra Formation (Fig.4.6). The organic matter in the pre-Permian section represents cavings.

Results of the maceral analyses for the coals and DOM are in Tables 4.1 (Nappamerri Formation) to 4.5 (Tirrawarra Formation) (in the Appendix). The average compositions of the coal seams are given in Table 4.6. These are plotted in Fig.4.7 and the compositions of the DOM in Fig.4.8. The coals have maceral contents of 7-57% vitrinite, 0-10% exinite and 43-85% inertinite. The DOM contains 0-50% vitrinite, but most samples contain less than 30%; 0-23% exinite and 50-100% inertinite.

As the samples contain so little exinite, and so much inertinite, the macerals have been regrouped in an attempt to enhance any differences amongst the samples. The maceral compositions of the coals and DOM in the cuttings are plotted in Fig.4.9, with vitrinite plus exinite (likely sources for hydrocarbons, Tissot et al., 1974), inertodetrinite, and the remaining inertinite macerals (micrinite, macrinite, semifusinite, fusinite) at the apices. In this plot the coals and DOM have 0-67% vitrinite plus exinite, 16-87% inertodetrinite and 5-45% remaining inertinites.

Microlithotype analyses of the cuttings are given in Table 4.7, and of the seams, in Table 4.8. These results are plotted in Fig.4.10. Except for one coal from the Patchawarra Formation, the seams have 2-25% vitrite plus clarite, between 10 and 45% intermediate microlithotypes, and 35 to 87% durite plus inertite.

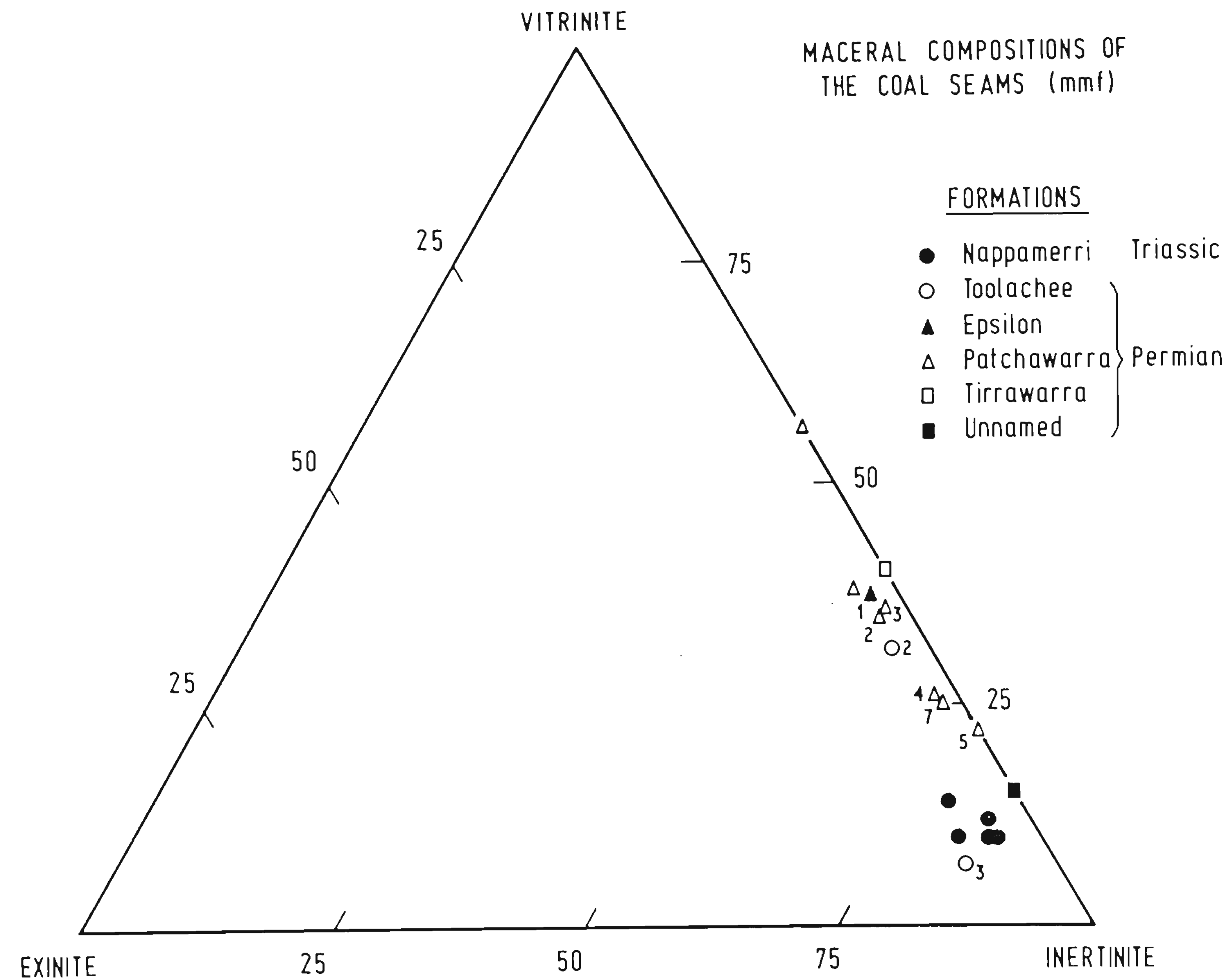


FIG. 4-7 MUDRANGIE 1 PATCHAWARRA TROUGH COOPER BASIN

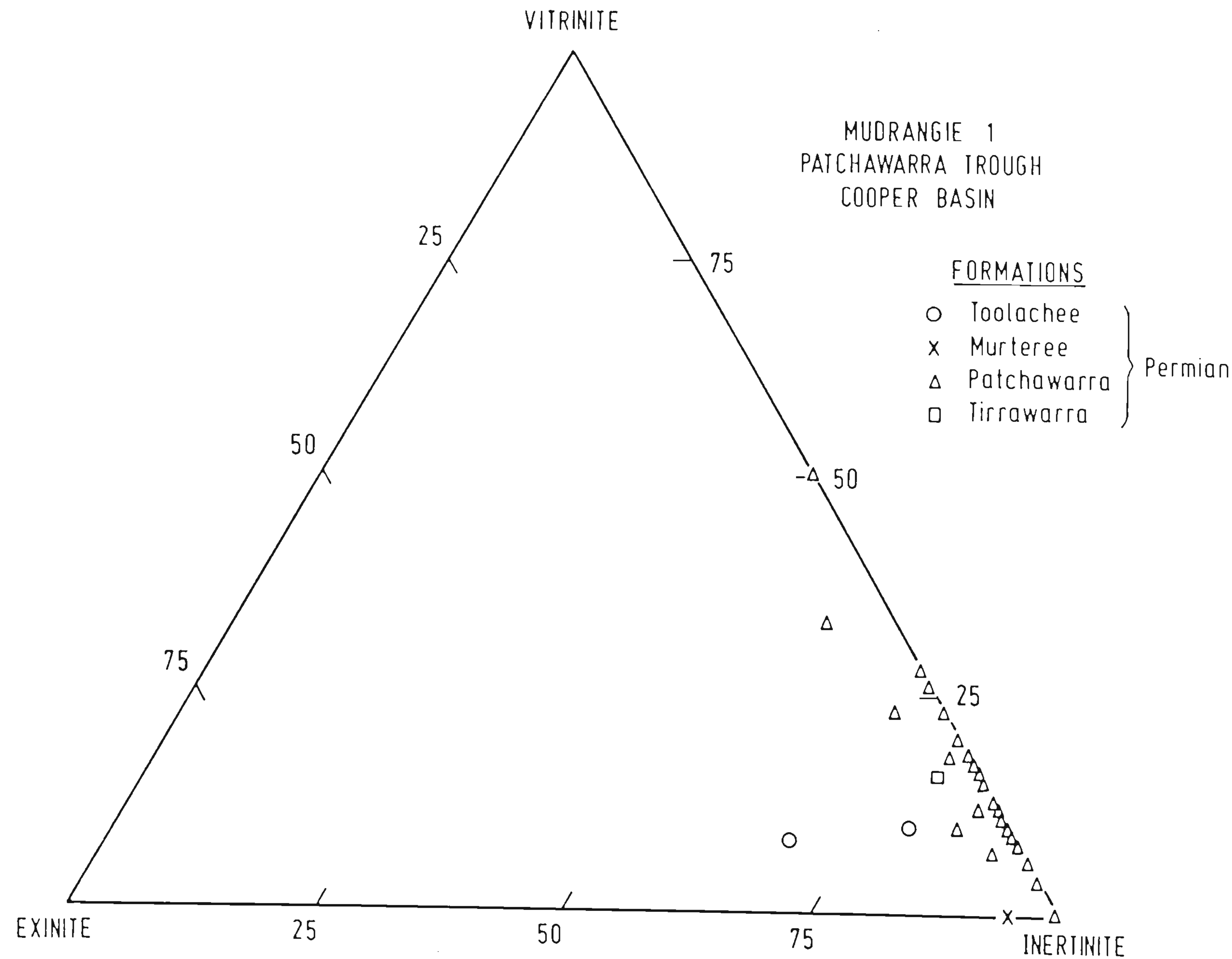


FIG. 4 - 8 MACERAL COMPOSITIONS OF THE DOM

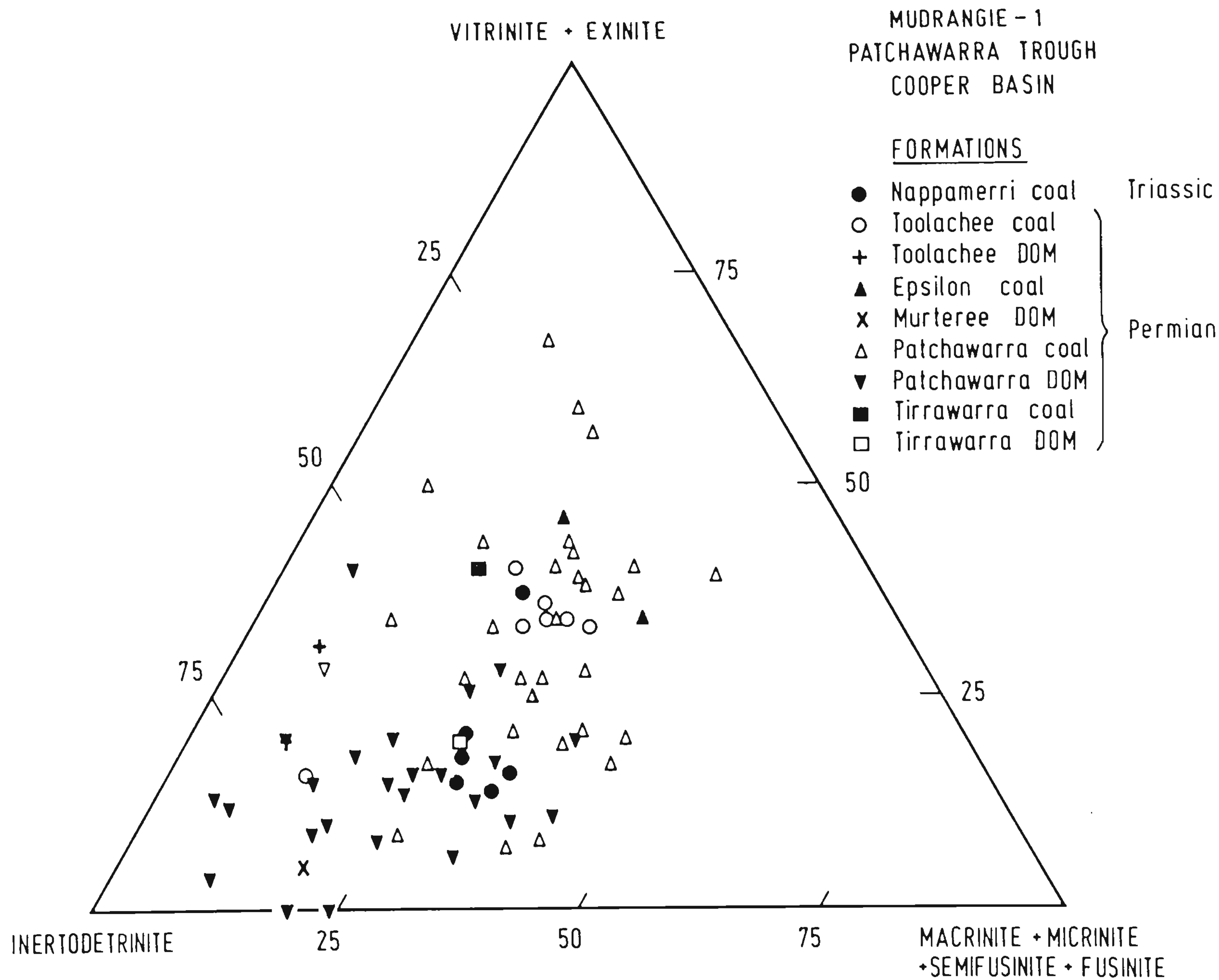
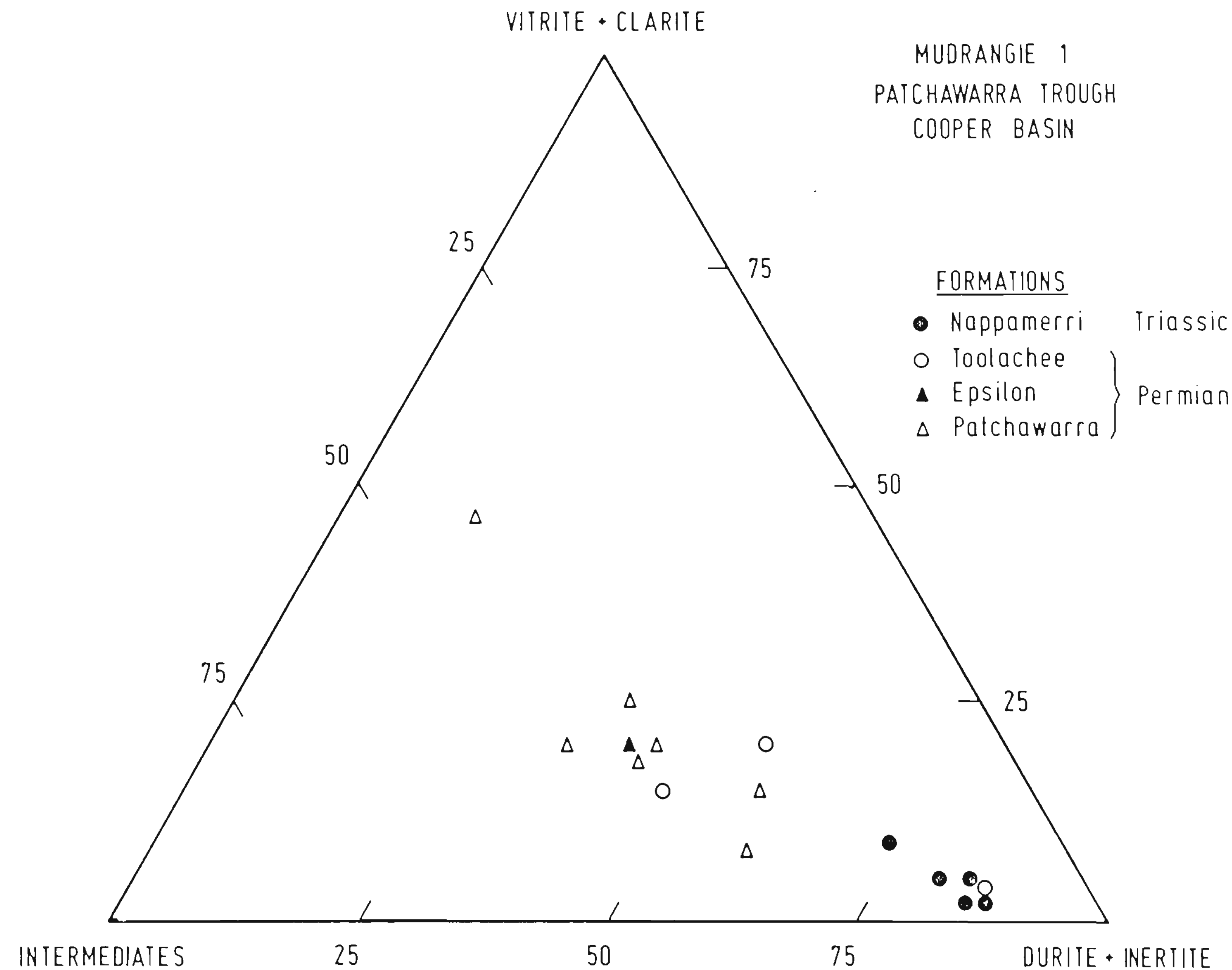


FIG. 4 - 9 MACERAL COMPOSITIONS OF THE CUTTINGS



VITRITE + CLARITE
MUDRANGIE 1
PATCHAWARRA TROUGH
COOPER BASIN
FORMATIONS
Nappamerri
Triassic
Toolachee
Epsilon
Patchawarra
Permian
25
50
75
INTERMEDIATES
DURITE + INERTITE

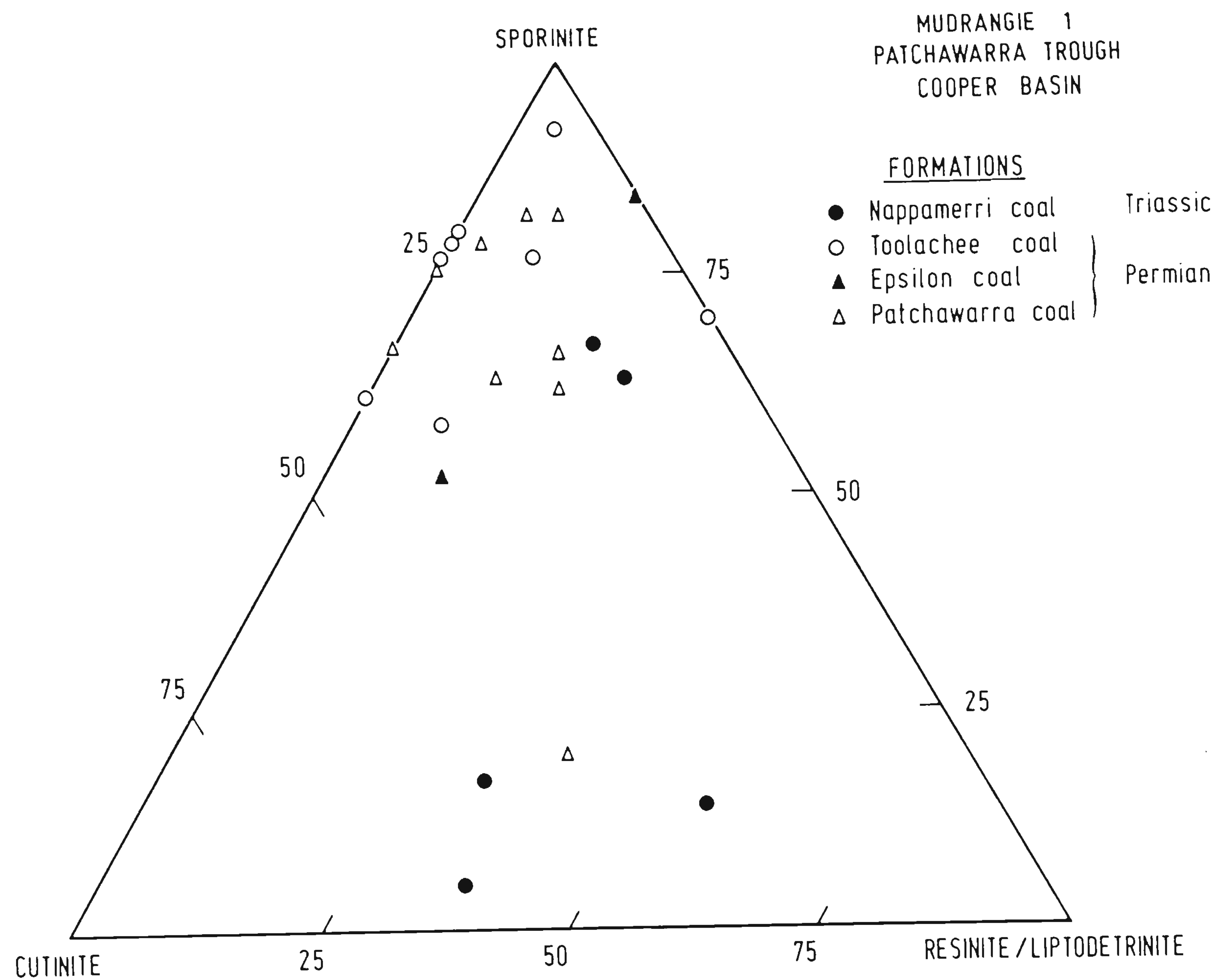
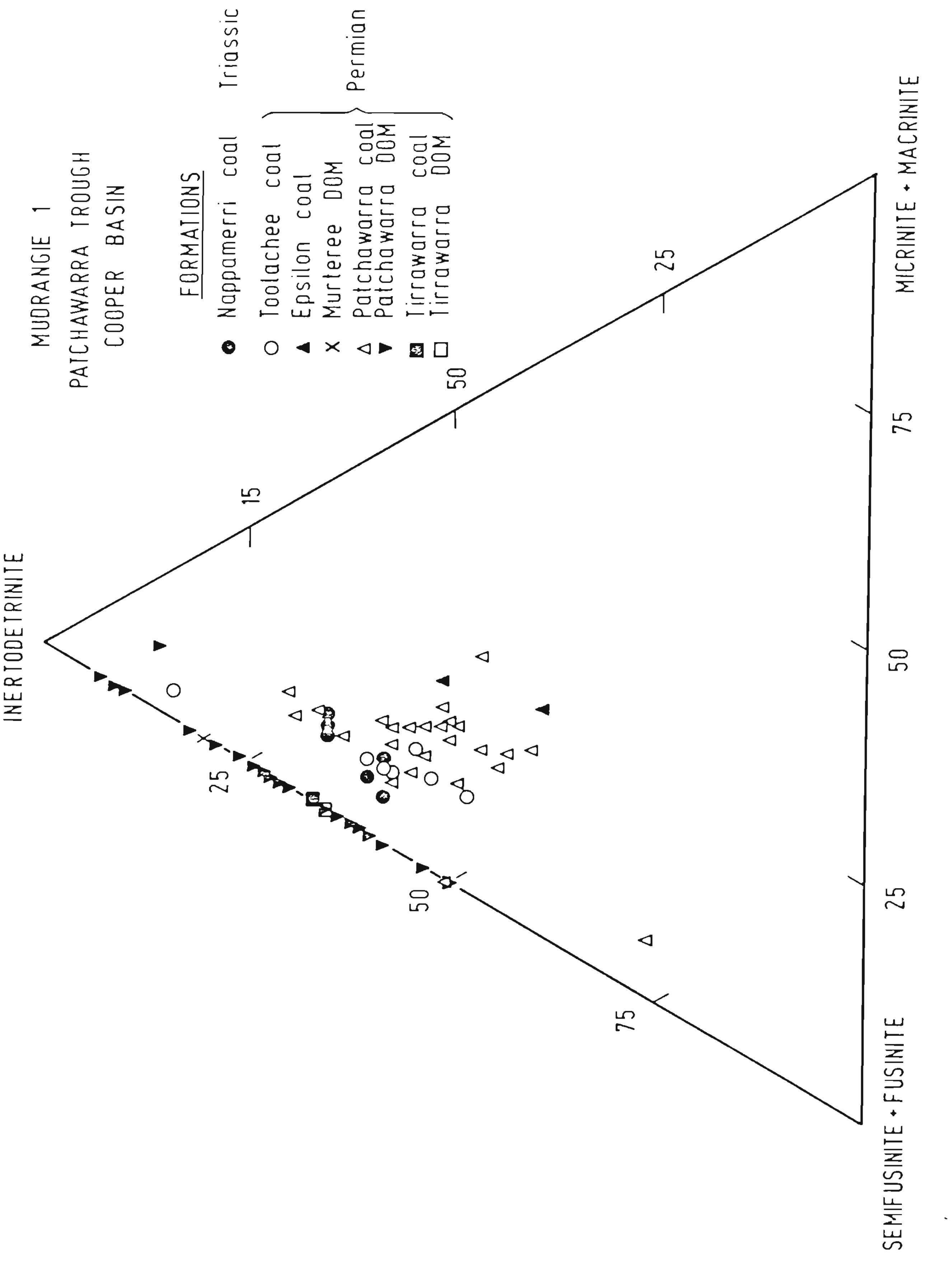


FIG. 4 - 11 COMPONENTS OF THE EXINITE MACERAL GROUP IN COALS


MUDRANGIE 1
PATCHAWARRA TROUGH
COOPER BASIN
FORMATIONS
Nappamerri coal
Triassic
Toolachee coal
Epsilon coal
Murteree DOM
Patchawarra coal
Patchawarra DOM
Tirrawarra coal
Tirrawarra DOM
Permian
INERTODETRINITE
SEMIFUSINITE + FUSINITE
MICRINITE + MACRINITE
15
25
50
75
25
50
75
25
50

The components of the exinite maceral group are plotted in Fig.4.11 for the coals (the amount of exinite DOM is too small for significant subdivision), and the components of the inertinite maceral group for coals and DOM in Fig.4.12. Sporinite is the dominant exinite in most coals; some have high cutinite and/or resinite/liptodetrinite. The bulk of the coals and all of the DOM contain 50% and more inertodetrinite.

The average volume of coal and DOM in the Mudrangie 1 samples is:

	DOM	COAL
Nappamerri Formation	0.40%	19.3%
Toolachee Formation	0.8%	74.7%
Epsilon Formation	-	98.0%
Murteree Shale	5.0% (one sample)	1.0%
Patchawarra Formation	4.4%	35.2%
(above Malabine Coal)	5.5%	40.0%
(below Malabine Coal)	3.7%	31.5%
Tirrawarra Formation	7.0% (one sample)	5.0%
Unnamed Formation	1.4%	1.8%

4. (iv) Discussion of results

Excluding the Tirrawarra and Murteree Formations (as they are represented by one sample only), the Patchawarra Formation rocks contain the highest average volume of DOM. The Patchawarra sequence above the Malabine Coal includes Upper Stage 4', Lower Stage 4 and uppermost Stage 3' (Thornton, 1979), and contains 5.5% by volume DOM, on average, and the rocks below the Malabine Coal (Figs.4.4 and 4.5), contain 3.7% DOM, on average.

The Patchawarra Formation DOM is inertinite-rich and generally includes a small proportion of vitrinite; exinite is rare. Small amounts of exinite occur near Patchawarra 6 seam, at the top of Stage 3', in Lower Stage 4 and in Upper Stage 4' (Fig.4.5). The samples contain less than 1%

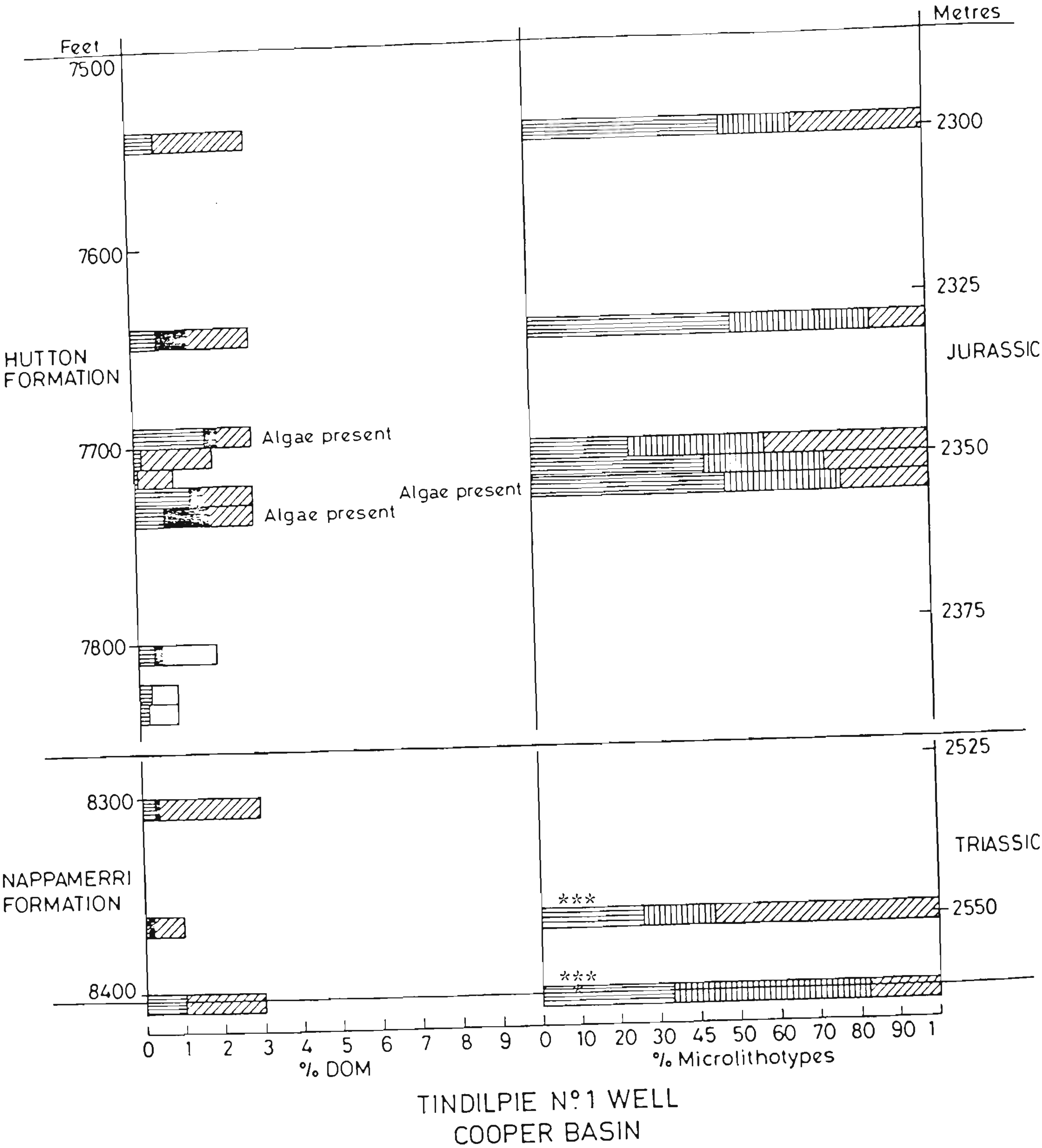


FIG. 4.13

Amount and type of DOM plus composition of associated coals.

*** Small volume of coal (see Table 4.10). May be cavings from the Lower Jurassic.

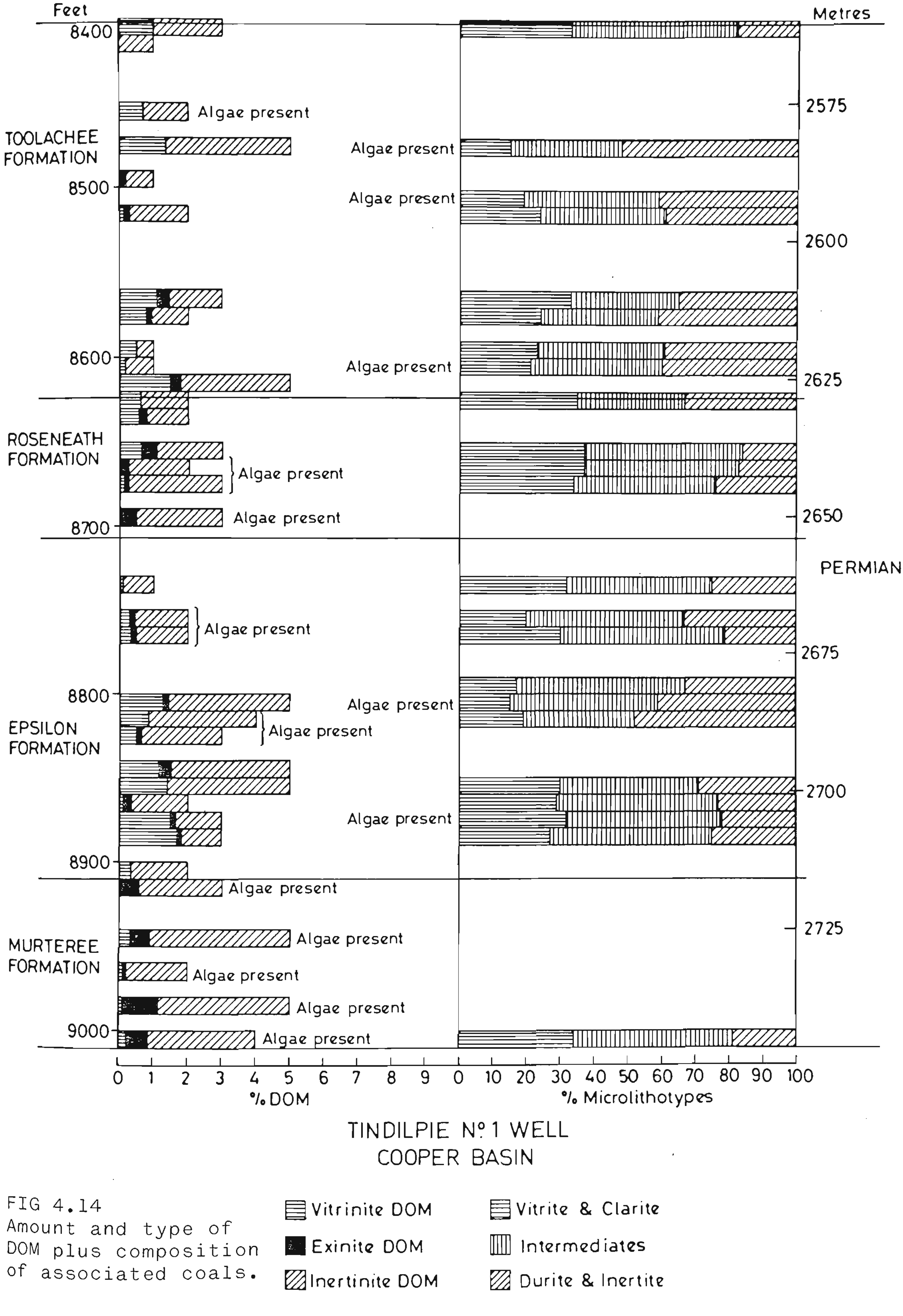


FIG 4.14
Amount and type of DOM plus composition of associated coals.

exinite, by volume, of the whole cutting.

The coal seams (except for Patchawarra 6) have low vitrite plus clarite contents (Fig.4.10) and high intermediate microlithotypes and/or durite plus inertite contents.

Very little DOM has been counted in the overlying Murteree, Epsilon, Toolachee and Nappamerri Formations, and only the Murteree contains more than 1% DOM (Figs.4.3, 4.2, Tables 4.3). The coal seams in the Toolachee and Epsilon Formations have similar compositions to those in the Patchawarra Formation (Tables 4.4 and 4.3): those from the Nappamerri Formation have very high durite plus inertite contents (Fig.4.10, Table 4.5).

The coals high in vitrite plus clarite found in Upper Stage 4' of the Fly Lake - Brolga area are not present in Mudrangie 1 nor is there a concentration of exinite DOM in the sequence.

The organic petrology of the Mudrangie 1 sedimentary rocks is similar to that in the Fly Lake - Brolga area, in that:

(i) the bulk of the DOM is inertinite;

(ii) most of the coal seams have low vitrite plus clarite contents with high intermediate microlithotypes and/or durite plus inertite.

Mudrangie 1 is situated at the eastern edge of the Patchawarra Trough, against the Gidgealpa - Merrimelia - Innamincka trend (Fig.4.1). The Fly Lake - Brolga area is in the centre of the Patchawarra Trough. Tindilpie 1, in the southern portion of the trough, contains the thickest and most complete Permian sequence in the Patchawarra Trough.

4. (v) Tindilpie 1

Cutting samples from Tindilpie 1 were prepared, and the organic matter

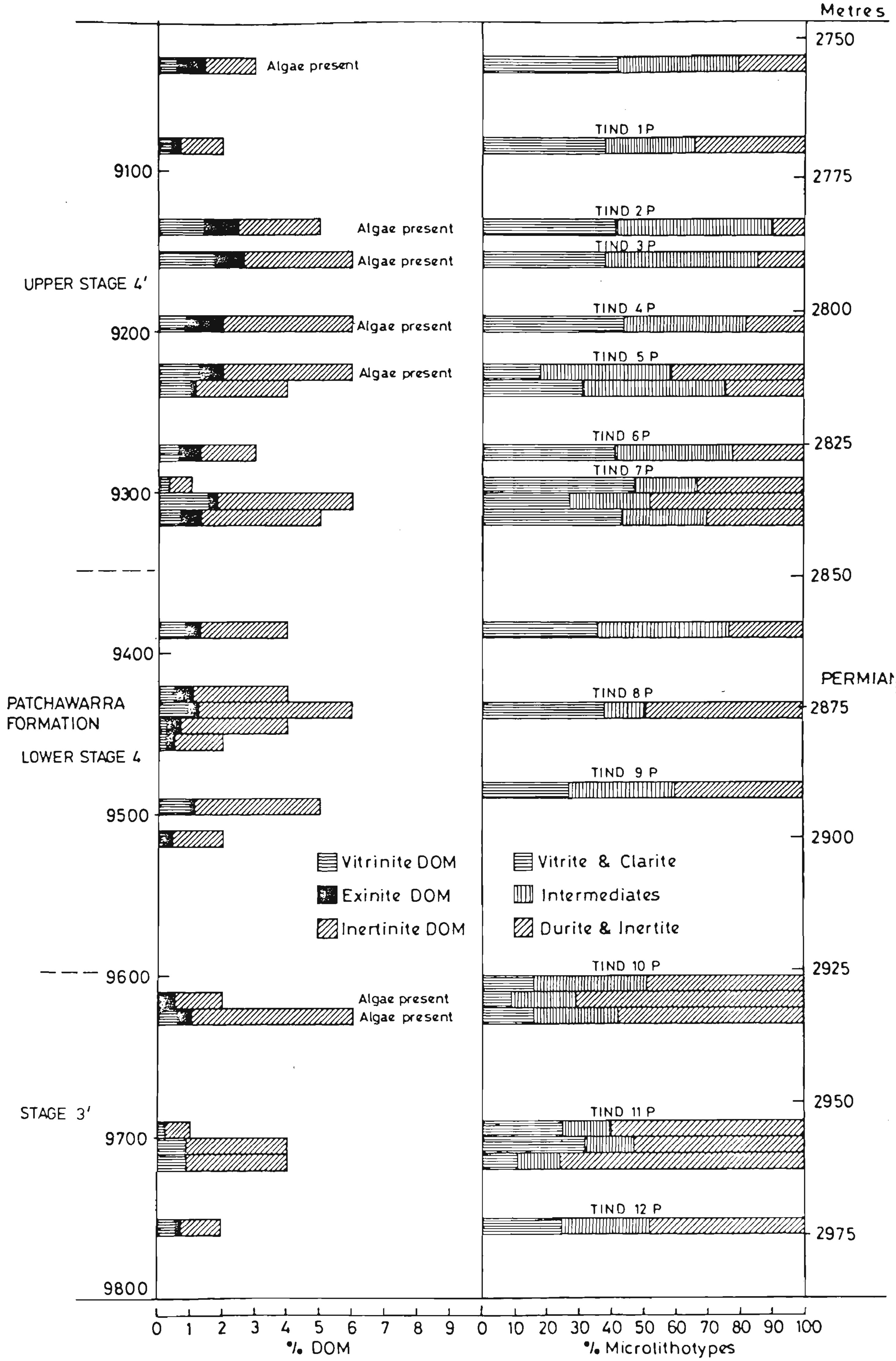


Fig.4.15 : Amount and type of DOM plus composition of as[illegible]chawarra Formation

TINDILPIE Nº1 WELL
COOPER BASIN

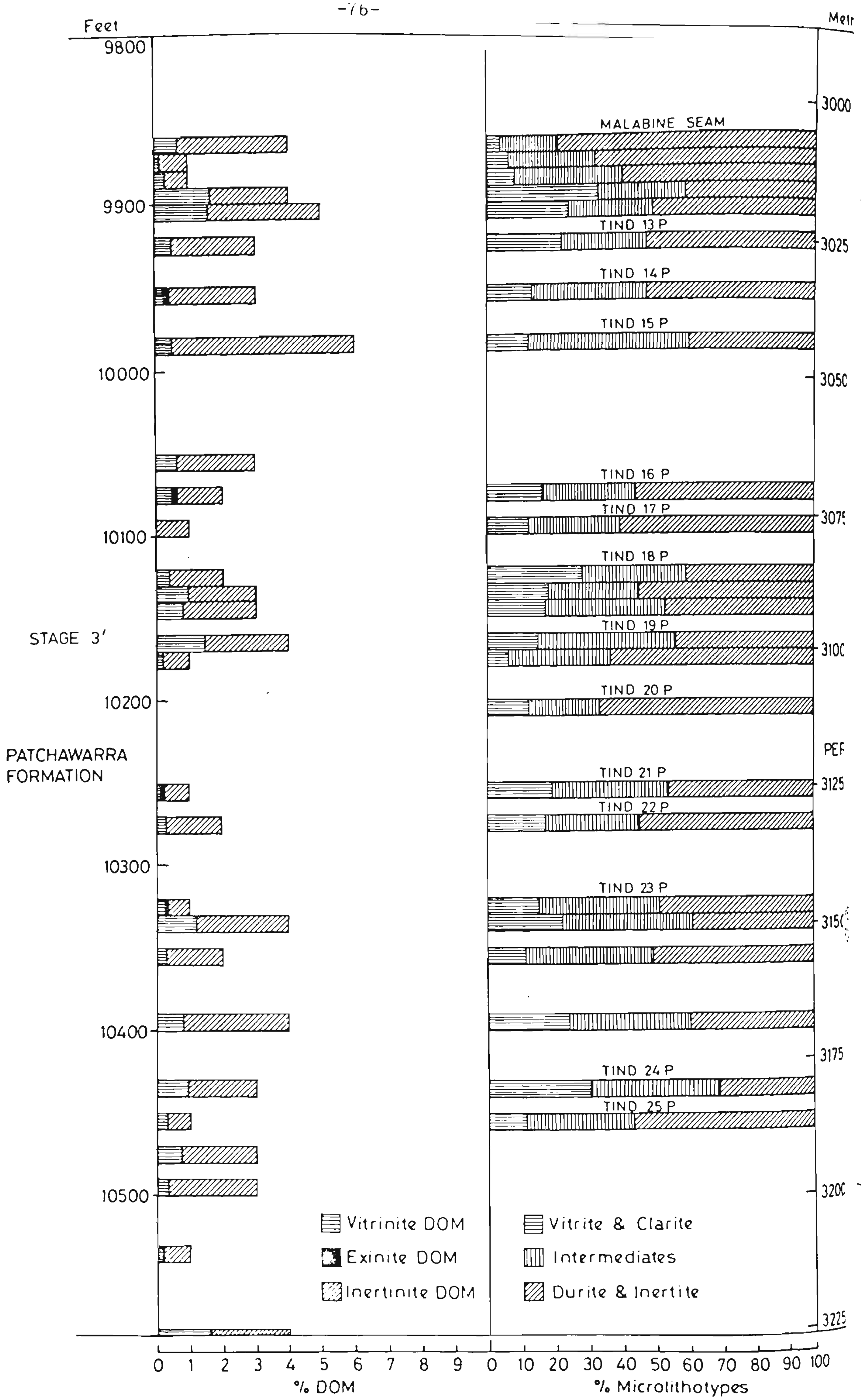


Fig. 4.16 : Amount and type of DOM and the composition of associated coals in the Patchwarra Formation

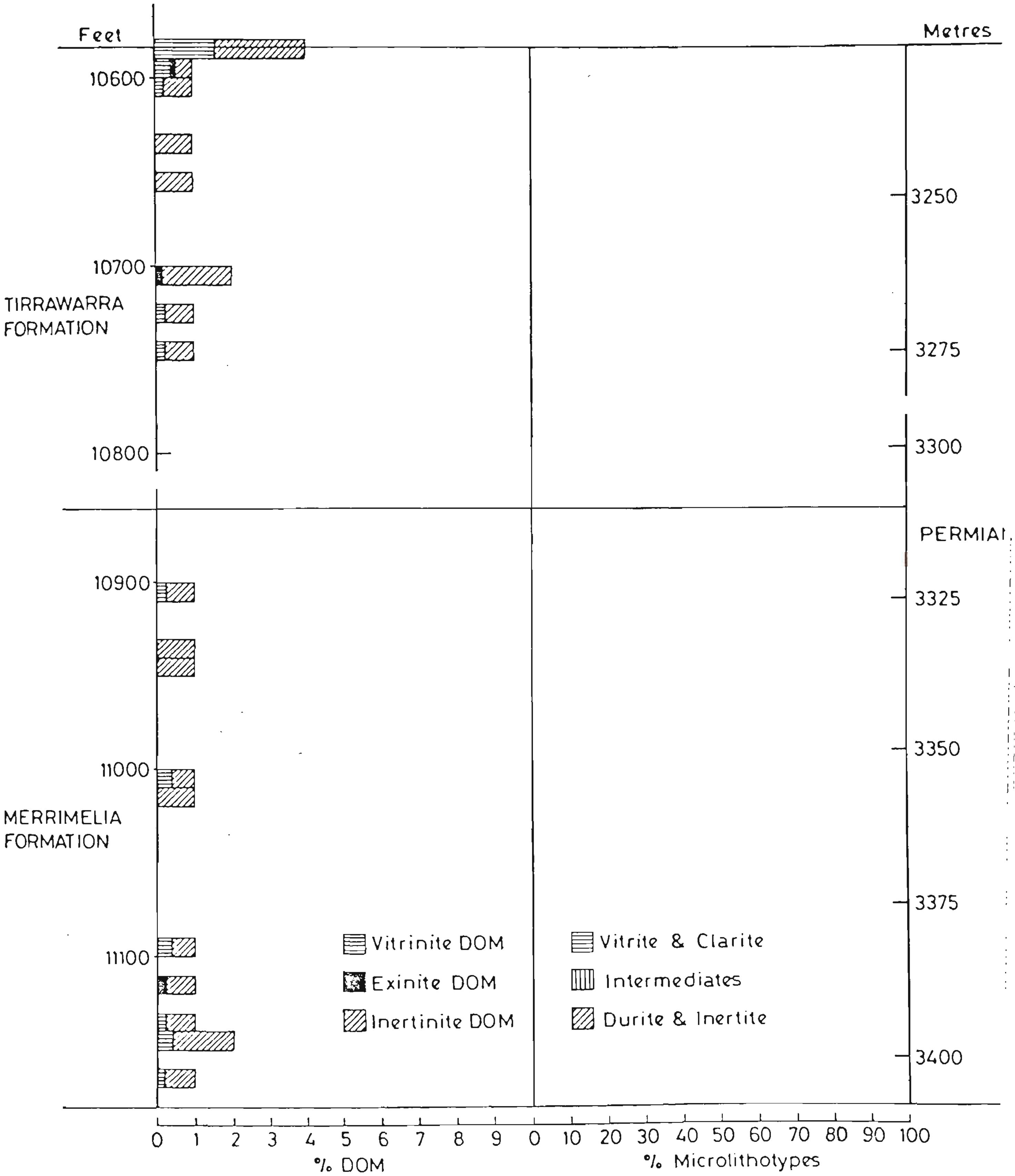


Fig. 4.17 : Amount and type of DOM in the Tirrawarra and Merrimelia Formations.

in them analysed petrographically, in the same way as those from Mudrangie 1.

Results of the analyses are given in Tables 4.9 to 4.16, and include the Jurassic Hutton Formation of the Eromanga Basin (Table 4.9) as well as the Triassic and Permian sequences down to the Merrimelia Formation (Table 4.17), (in Appendix).

The sampling points for the cutting samples and the amount and type of DOM in each one, plus microlithotype compositions of coal seams when available, are shown in Fig.4.13 (Hutton Formation) to 4.17 (Tirrawarra and Merrimelia Formations). The Patchawarra Formation (Figs.4.15 and 4.16) is the thickest unit sampled containing many coal seams and a high proportion of DOM.

4. (v)a. Merrimelia and Tirrawarra Formations

The maceral compositions of coals and DOM in the Merrimelia and Tirrawarra Formations are plotted in Fig.4.18. Both coals and DOM are inertinite-rich. Their vitrinite contents are 12-50%, exinite 0-9% and inertinite, 45-86%. In Fig.4.19 vitrinite plus exinite (likely sources for hydrocarbons) are plotted against inertodetrinite and the remaining inertinites (Tables 4.17, 4.16). Coals contain 14-55% vitrinite plus exinite; the DOM, 18-20%. Inertodetrinite content is 17-46% in the coals, 50-100% of the DOM. Remaining inertinites are 10-57% in the coal, 22-55% of the DOM. The reflectance for vitrinite $R_{o\ max}$ at 3214 m (base of the Patchawarra Formation) in Tindilpie 1 is 1.30% (Kantsler et al., 1978). At this rank exinite is difficult to distinguish, but it has been identified in some of the samples.

4. (v)b. Patchawarra Formation

The data for the Patchawarra Formation are voluminous and the

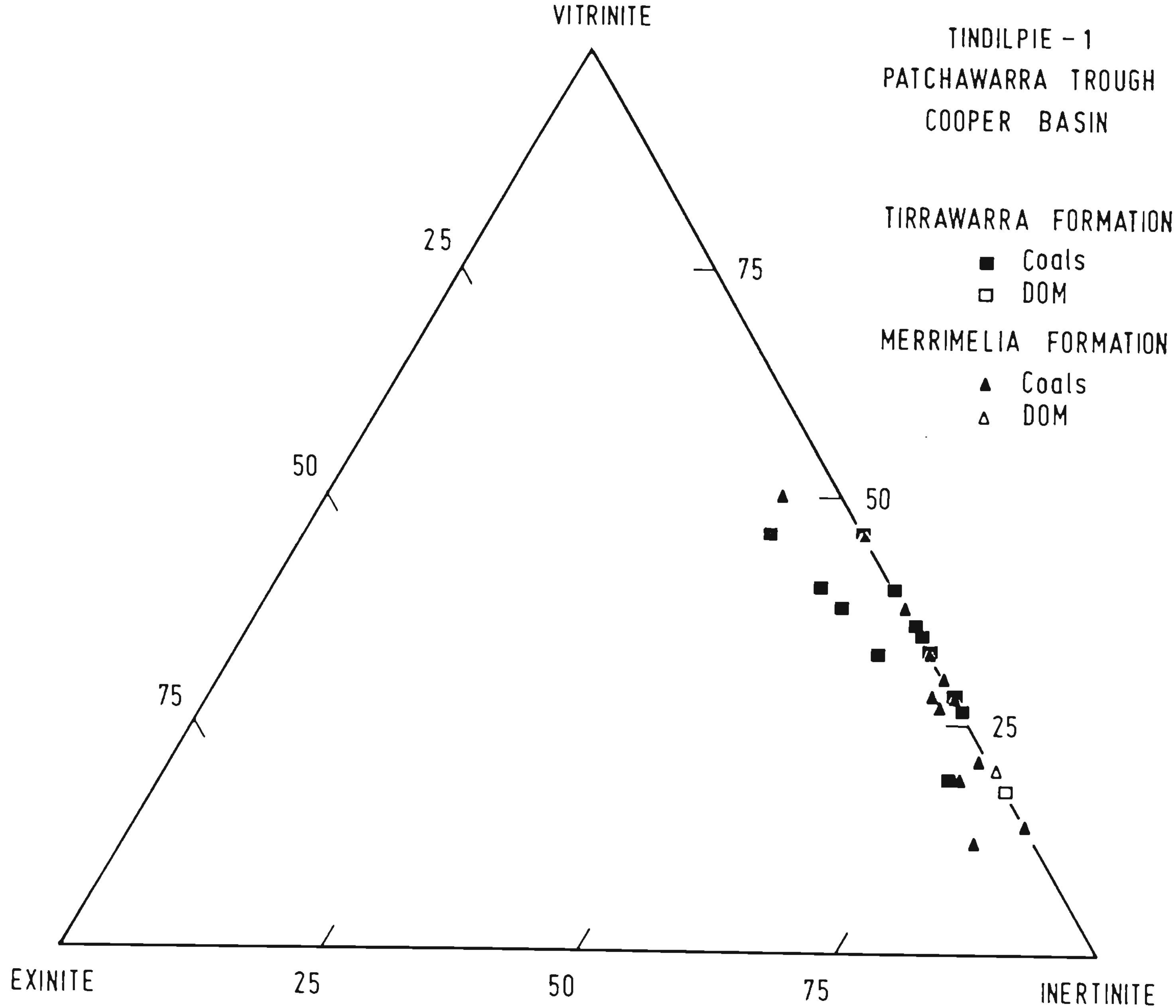
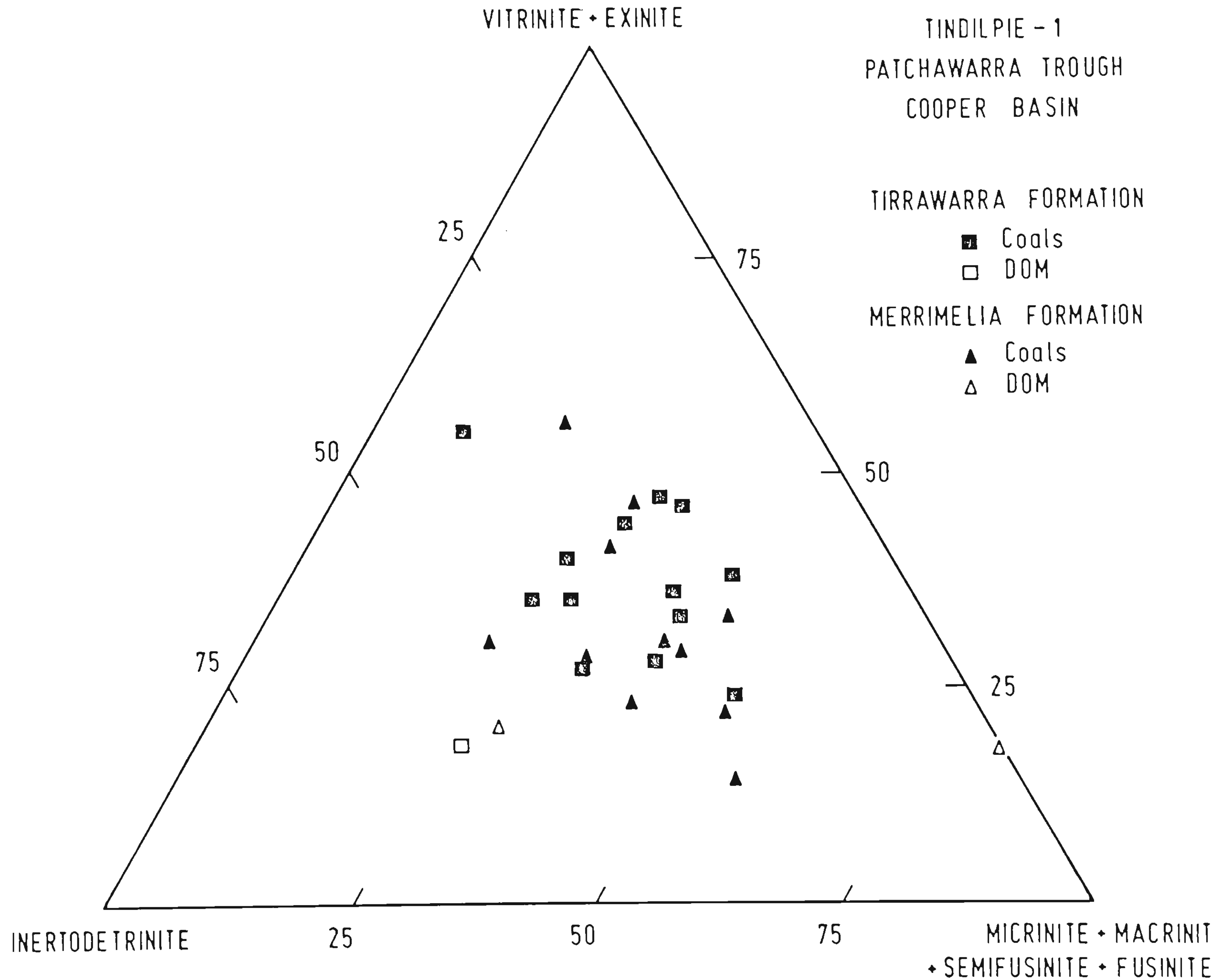


FIG. 4-18 MACERAL COMPOSITIONS OF COALS AND DOM FROM THE TIRRAWARRA AND MERRIMELIA FORMATIONS


VITRINITE + EXINITE
TINDILPIE - 1
PATCHAWARRA TROUGH
COOPER BASIN
TIRRAWARRA FORMATION
Coals
DOM
MERRIMELIA FORMATION
Coals
DOM
25
50
75
75
50
25
INERTODETRINITE
25
50
75
MICRINITE + MACRINITE
+ SEMIFUSINITE + FUSINITE

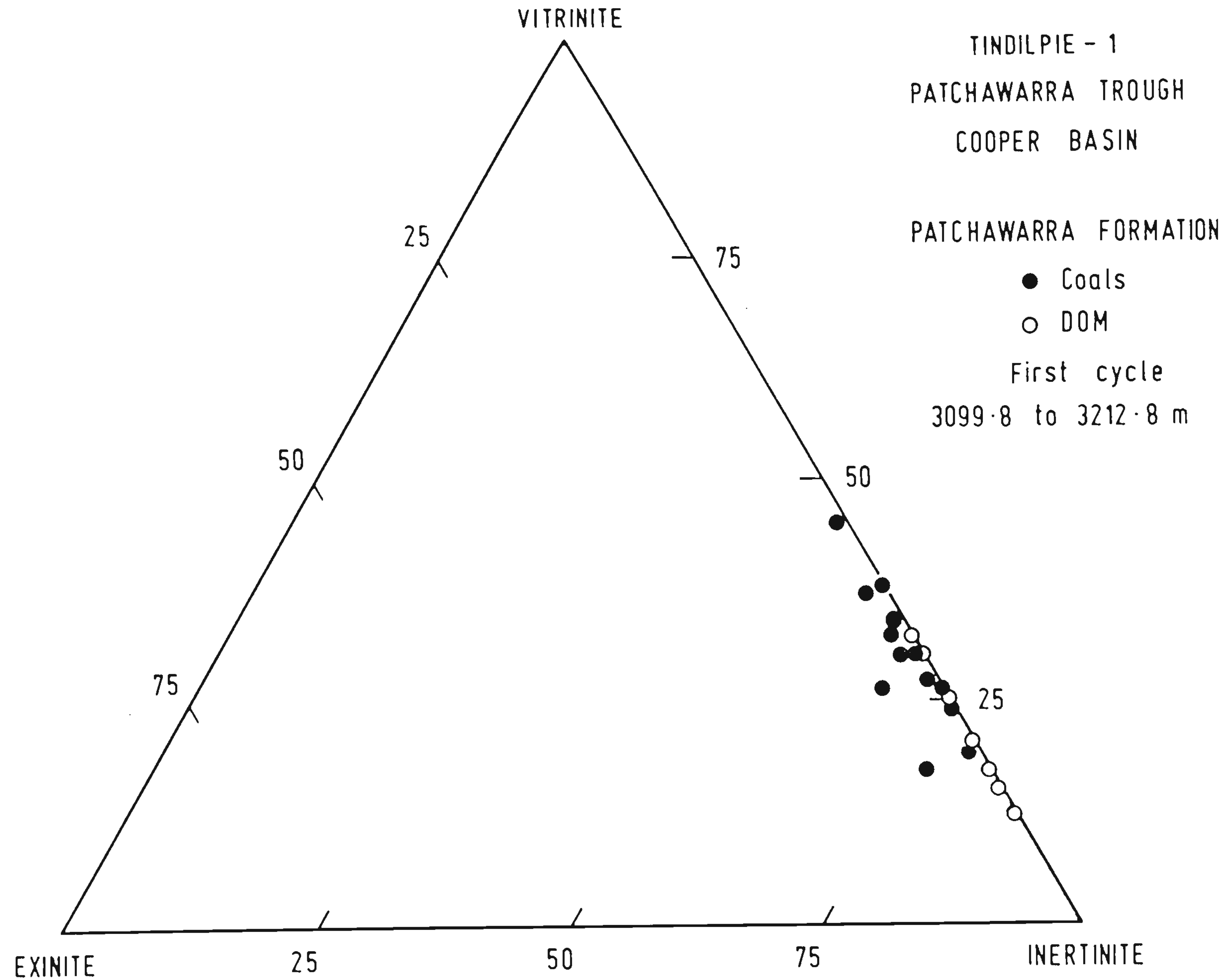
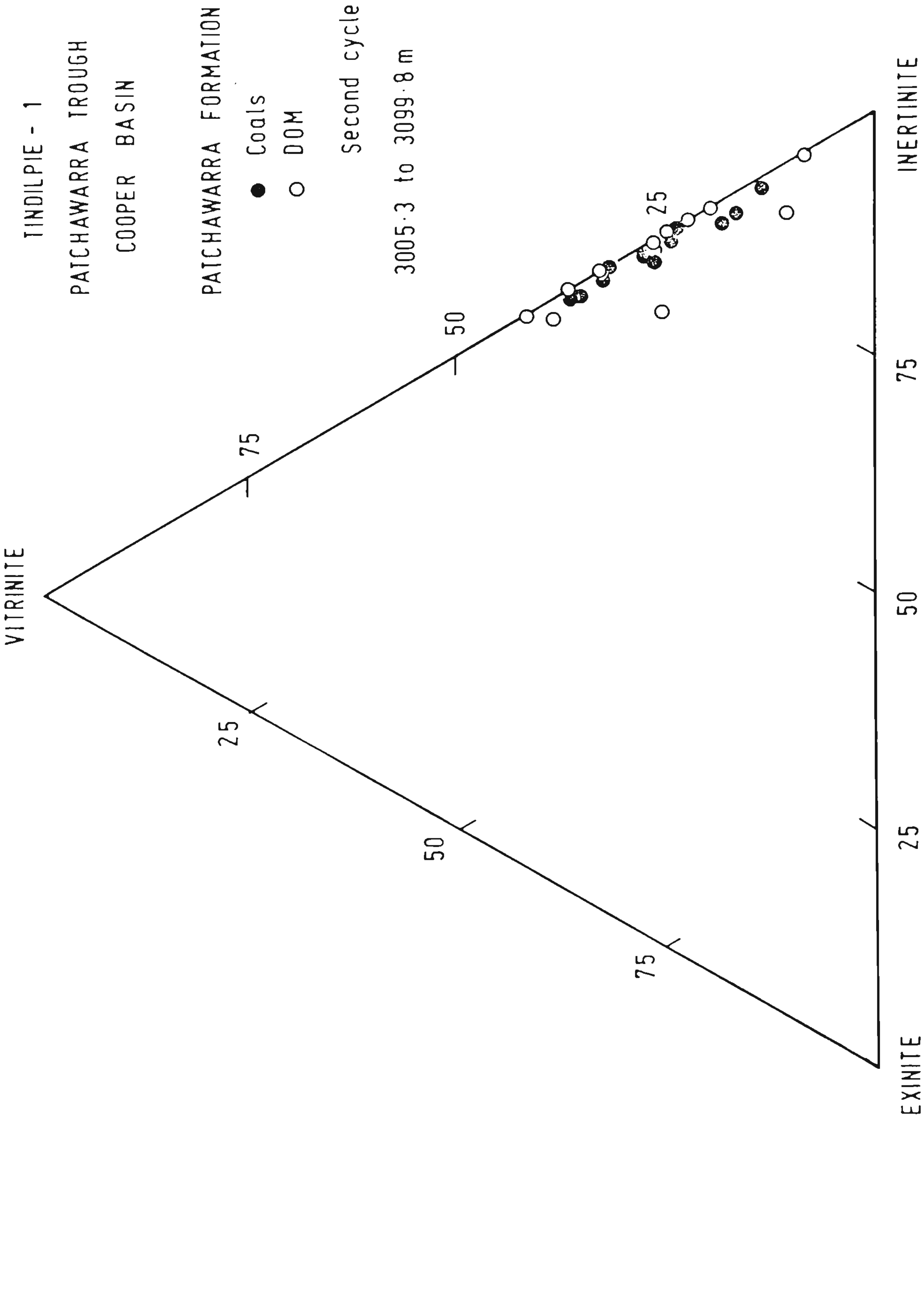


FIG. 4-20 MACERAL COMPOSITIONS OF COALS AND DOM FROM THE FIRST CYCLE OF THE PATCHAWARRA FORMATION


TINDILPIE - 1
PATCHAWARRA TROUGH
COOPER BASIN
PATCHAWARRA FORMATION
● Coals
○ DOM
Second cycle
3005·3 to 3099·8 m
VITRINITE
INERTINITE
EXINITE
25
50
75
25
50
75
25
50
75

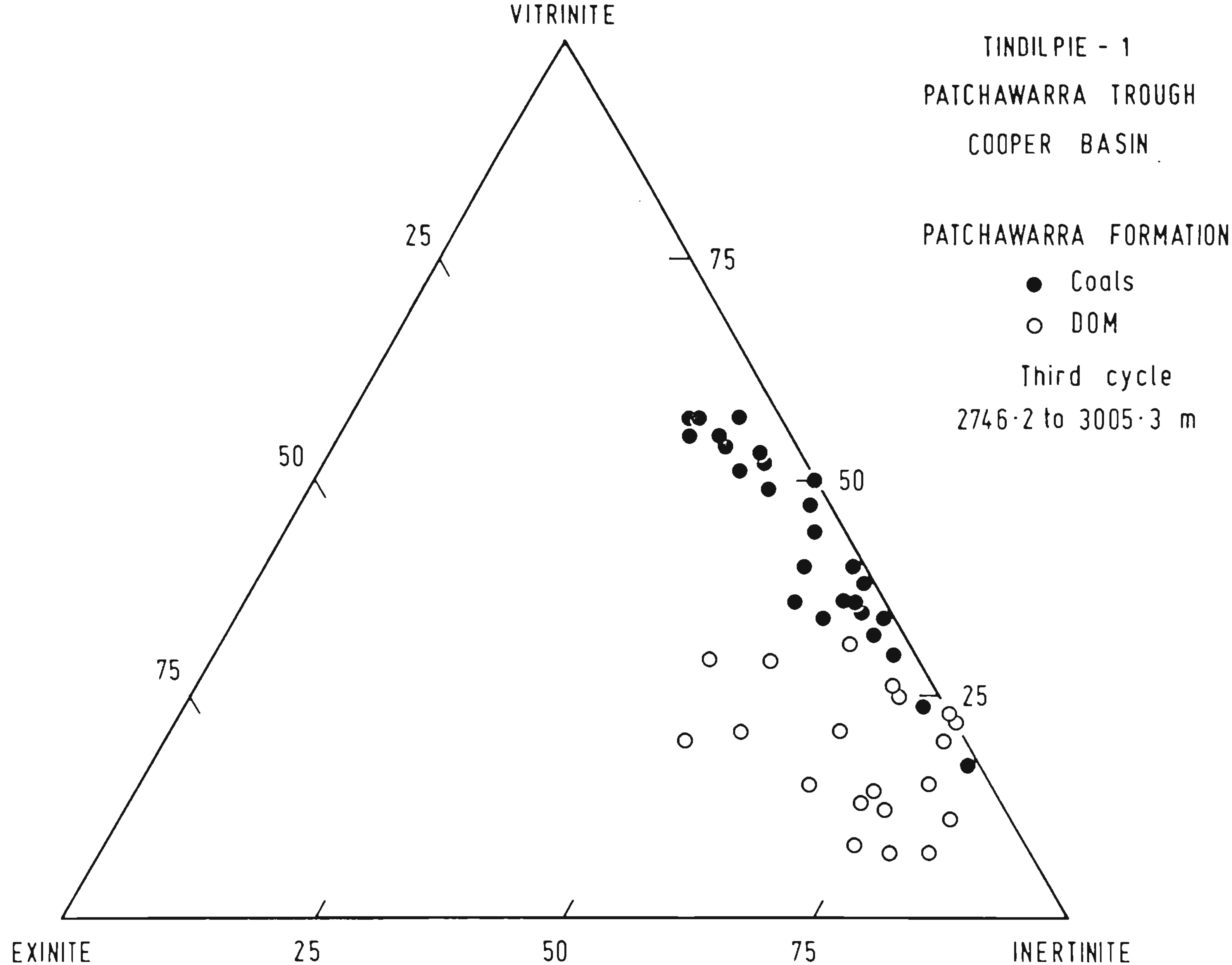


FIG. 4-22 MACERAL COMPOSITIONS OF COALS AND DOM FROM THE THIRD CYCLE OF THE PATCHAWARRA FORMATION

sequence has been split into three sections, based on the occurrence of two seams which are particularly low in vitrite plus clarite and high in durite plus inertite and which are taken here as representing the end of cycles of coal formation. The first cycle is from the base of the Patchawarra Formation at 3212.6 m (10540 ft) to 3096.8 m (10160 ft), a thickness of 115.8 m, which is marked in Fig.4.16 as the TIND 19P seam. The seam contains even less vitrinite and more inertinite than those below it (Table 4.15), and may represent a stillstand which permitted severe oxidation of the peatlands. The inertinite is predominantly semifusinite plus inertodetrinite (Table 4.15). The first cycle coals and DOM are inertinite-rich (Fig.4.20), with 12-45% vitrinite, 0-6% exinite, and 54-87% inertinite.

The second cycle is from 3096.8 m (10160 ft) up to the top of the Malabine Coal at 3005.3 m (9860 ft) a thickness of 91.5 m. The Malabine Coal also has an extremely low vitrinite and high inertinite contents and is a good marker, being 15 m thick in many locations in the Patchawarra Trough (Fig.4.16). The maceral compositions of the coals and DOM in the second cycle are similar to those in the first cycle (vitrinite 8-41%, exinite 0-8%, inertinite 59-91%) (Fig.4.21). Cycles one and two comprise the lower two-thirds of Stage 3 of the Patchawarra Formation.

The third cycle, the Patchawarra Formation above the Malabine seam, from 3005.3 m (9860 ft) up to 2746.2 m (9010 ft) a thickness of 259.1 m, comprises, the upper part of Stage 3', Lower Stage 4 and Upper Stage 4' (Fig.4.15). The maceral compositions of the coals and DOM in the third cycle are plotted in Fig.4.22. The coals in this cycle contain 17-57% vitrinite, 0-10% exinite and 34-82% inertinite. The DOM contains more exinite than the previous two cycles, with 8-31% vitrinite, 0-27% exinite and 50-82% inertinite. The maceral compositions of coals show

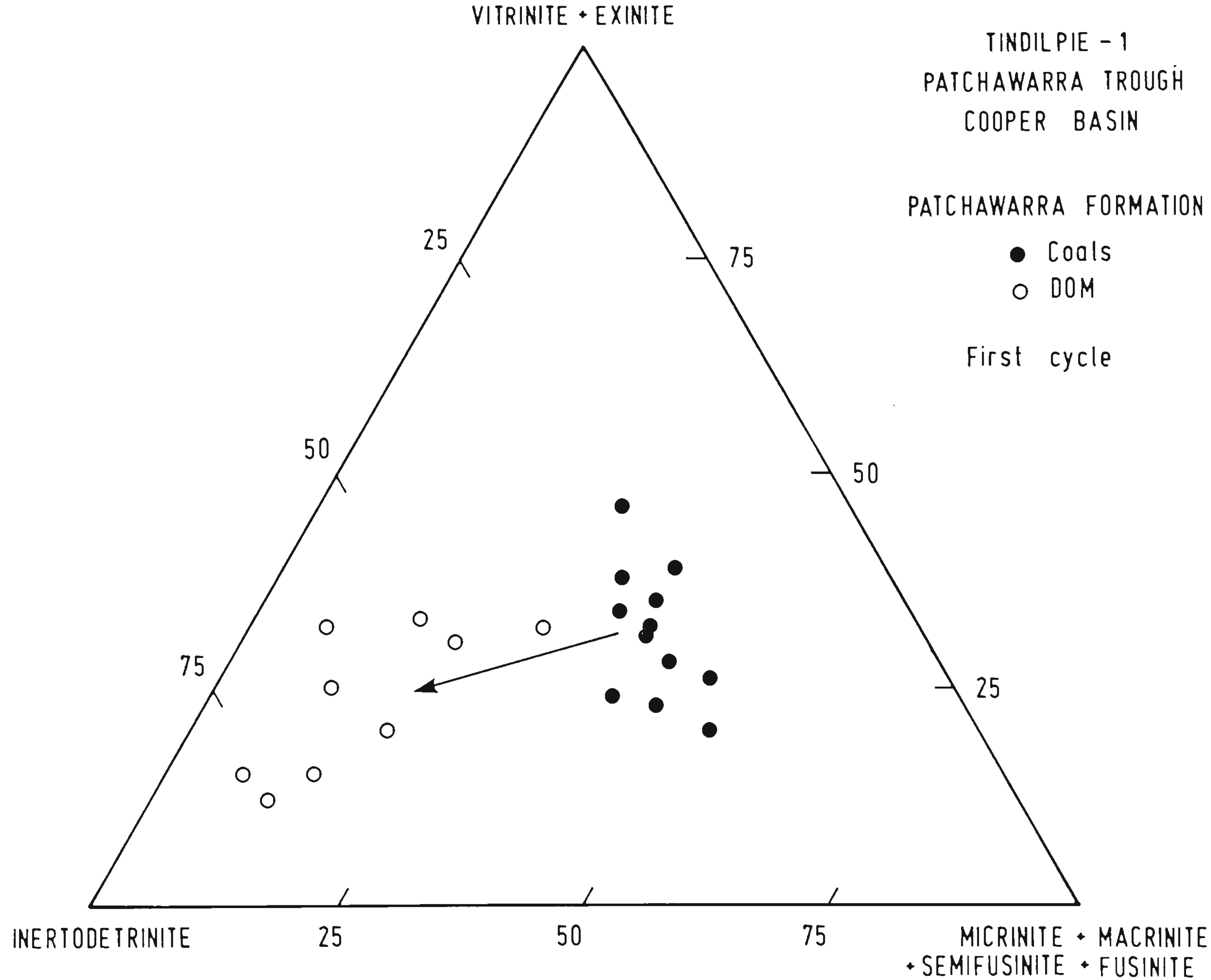
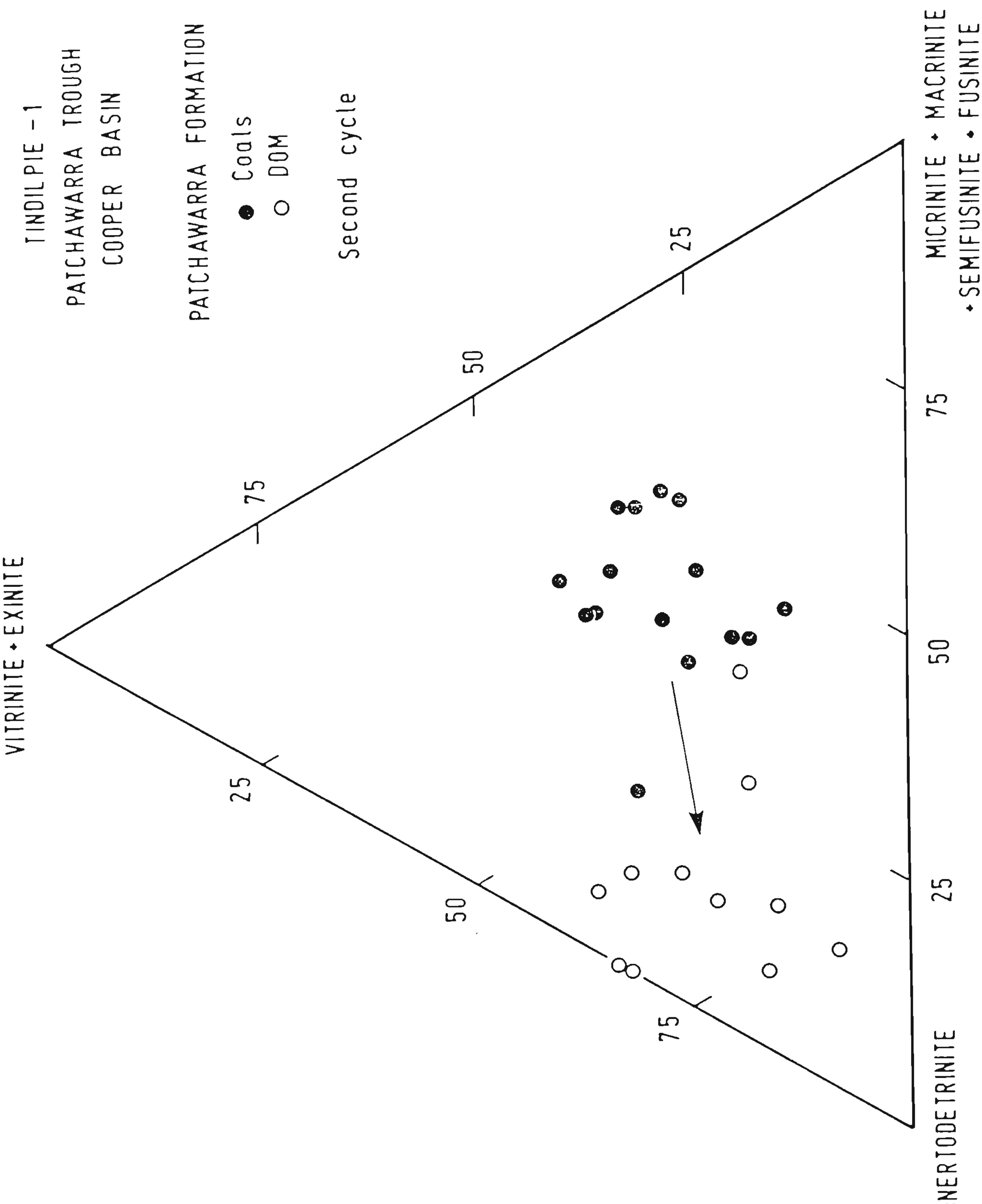


FIG. 4-23 VITRINITE + EXINITE (LIKELY SOURCES FOR HYDROCARBONS) AGAINST INERTINITES


TINDILPIE -1
PATCHAWARRA TROUGH
COOPER BASIN
PATCHAWARRA FORMATION
Coals
DOM
Second cycle
VITRINITE + EXINITE
MICRINITE + MACRINITE + SEMIFUSINITE + FUSINITE
INERTODETRINITE
25
50
75
25
50
75
75
50
25

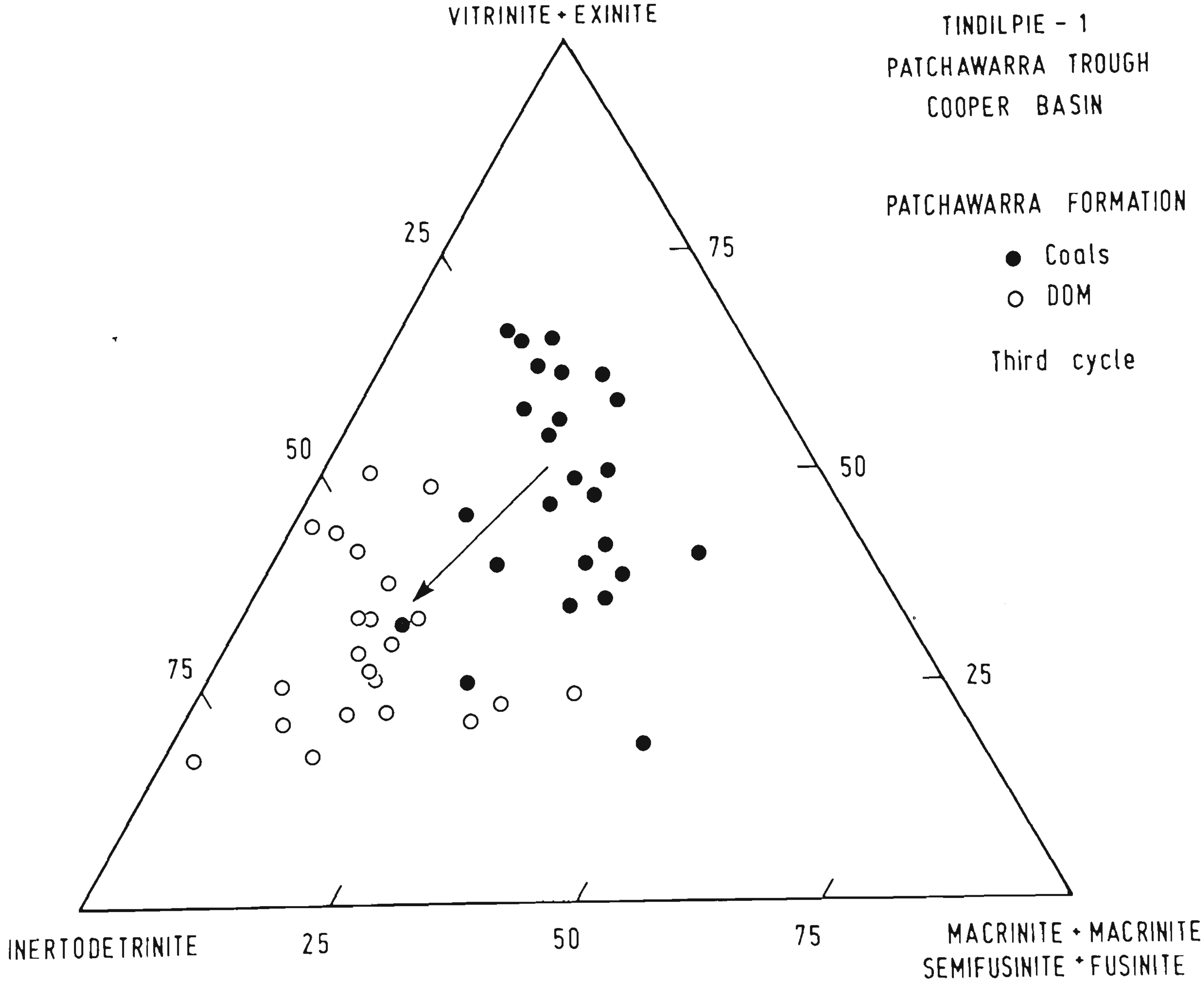


FIG. 4-25 VITRINITE + EXINITE (LIKELY SOURCE MATERIAL FOR HYDROCARBONS) AGAINST INERTINITES

a much wider variation in the third cycle than in the first and second cycles. The most striking variation in the DOM compared with cycles 1 and 2 is the increase in exinite content (Fig.4.22).

The maceral compositions plotted with the co-ordinates vitrinite plus exinite, inertodetrinite, remaining inertinites (Figs.4.23, 4.24, 4.25) for the three cycles show the similarities between cycles one and two, and the differences between these two cycles and three. This type of plot shows a separation of the coal from the DOM on the basis of their inertodetrinite contents. In the three cycles the vitrinite plus exinite contents of the coals and DOM overlap extensively and their inerto-detrinite components do not. In cycle one, the inertodetrinite in coals is 22-35%, and 38-77% in the DOM. In the second cycle, vitrinite plus exinite overlap even more for the coals and DOM. Inertodetrinite is 20-50% in the coal, 44-78% in the DOM. In cycle three, the inerto-detrinite content of the coals is 16-51%, and 37-80% in the DOM.

The DOM in the first cycle is displaced downwards towards the inerto-detrinite corner at a slight angle from the coals (Fig.4.23). The second cycle DOM is displaced less steeply from the coals (Fig.4.24). The third cycle coals and DOM are different (Fig.4.25) with a steep displacement of DOM from the coals.

The exinite content of cycles one and two is low, and the different components of this maceral group have not been plotted. The compo-nents of the exinite group in cycle three are shown in Fig.4.26. Sporinite is dominant, but the coal in several samples, and the DOM in one, have similar proportions of sporinite, cutinite and resinite and/or alginite. Those cuttings where alginite is present are marked to indicate its presence on Fig.4.15.

Inertinite is abundant in both coals and DOM in the Patchawarra

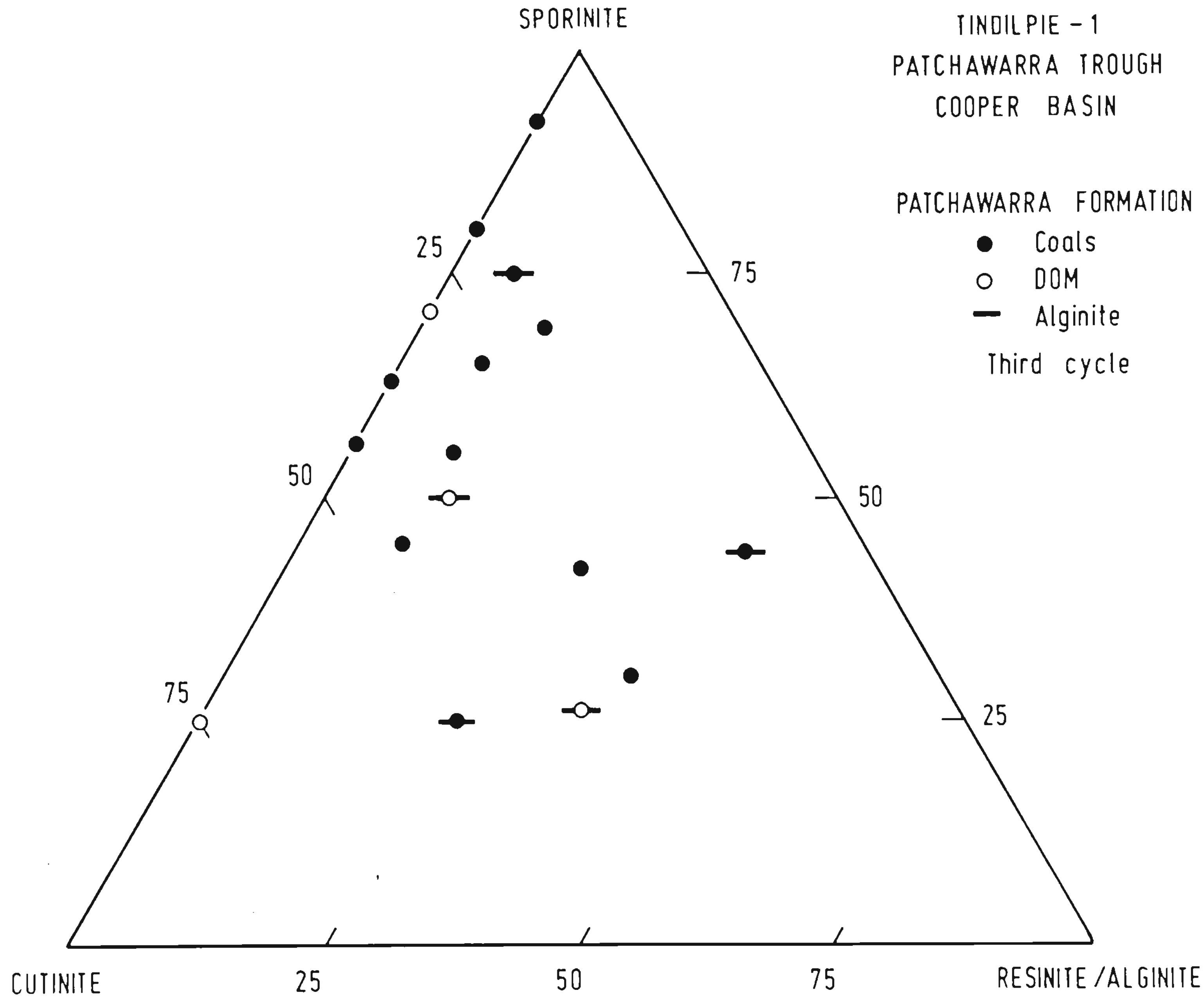


FIG. 4-26 COMPONENTS OF THE EXINITE GROUP IN COALS AND DOM FROM THE THIRD CYCLE OF THE PATCHAWARRA FORMATION

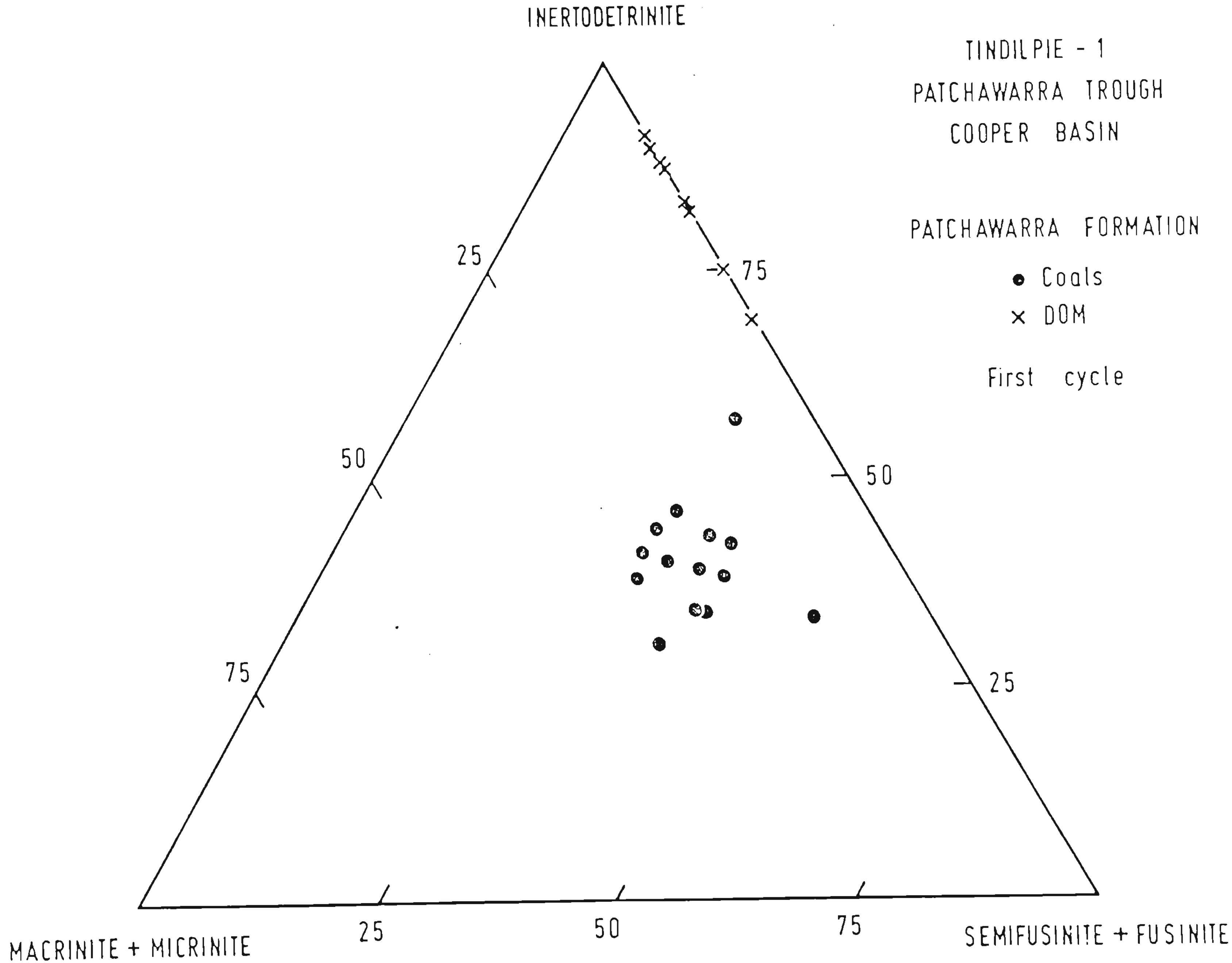


FIG. 4-27 COMPONENTS OF THE INERTINITE MACERAL GROUP

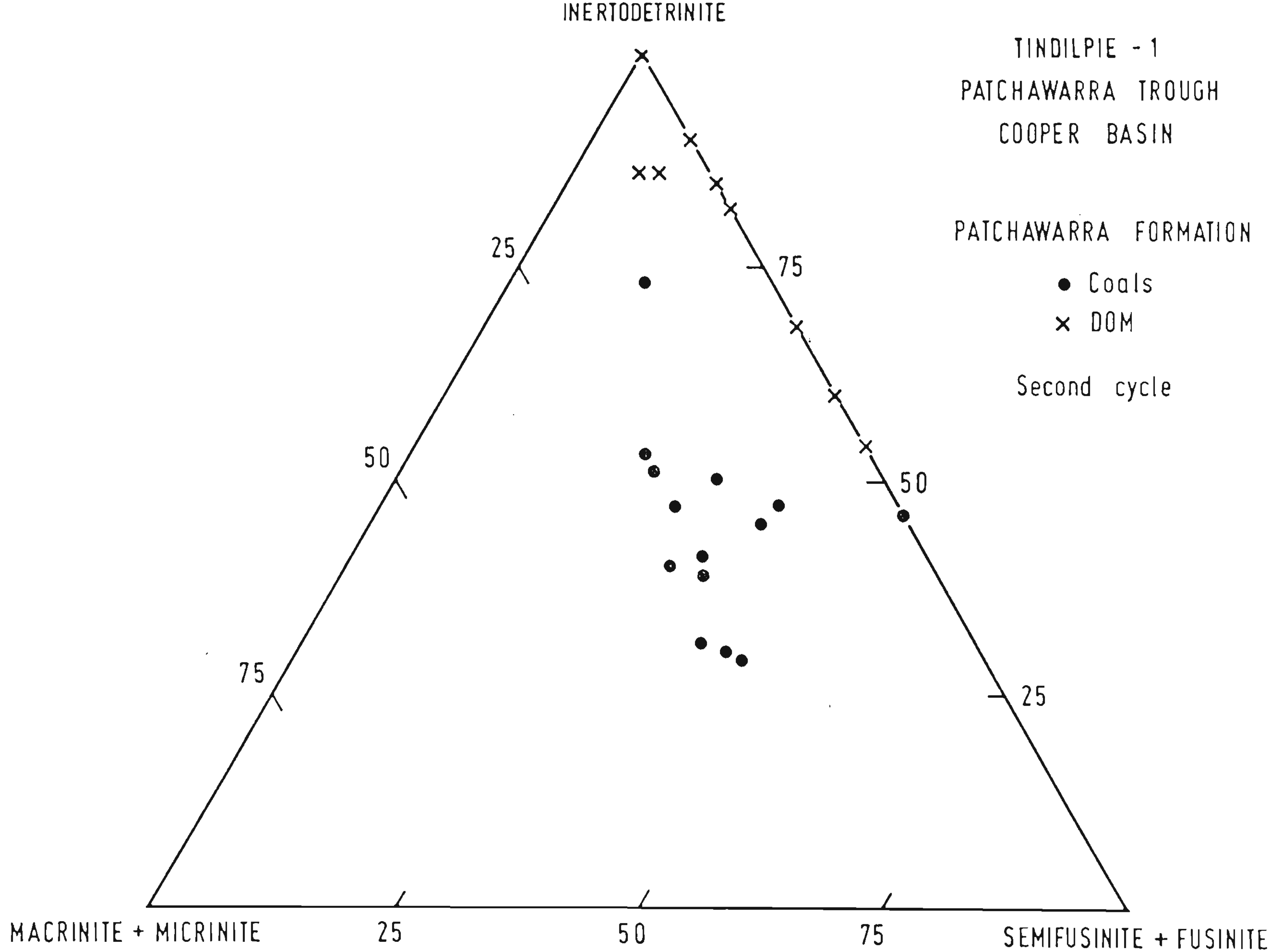


FIG. 4·28 COMPONENTS OF THE INERTINITE MACERAL GROUP

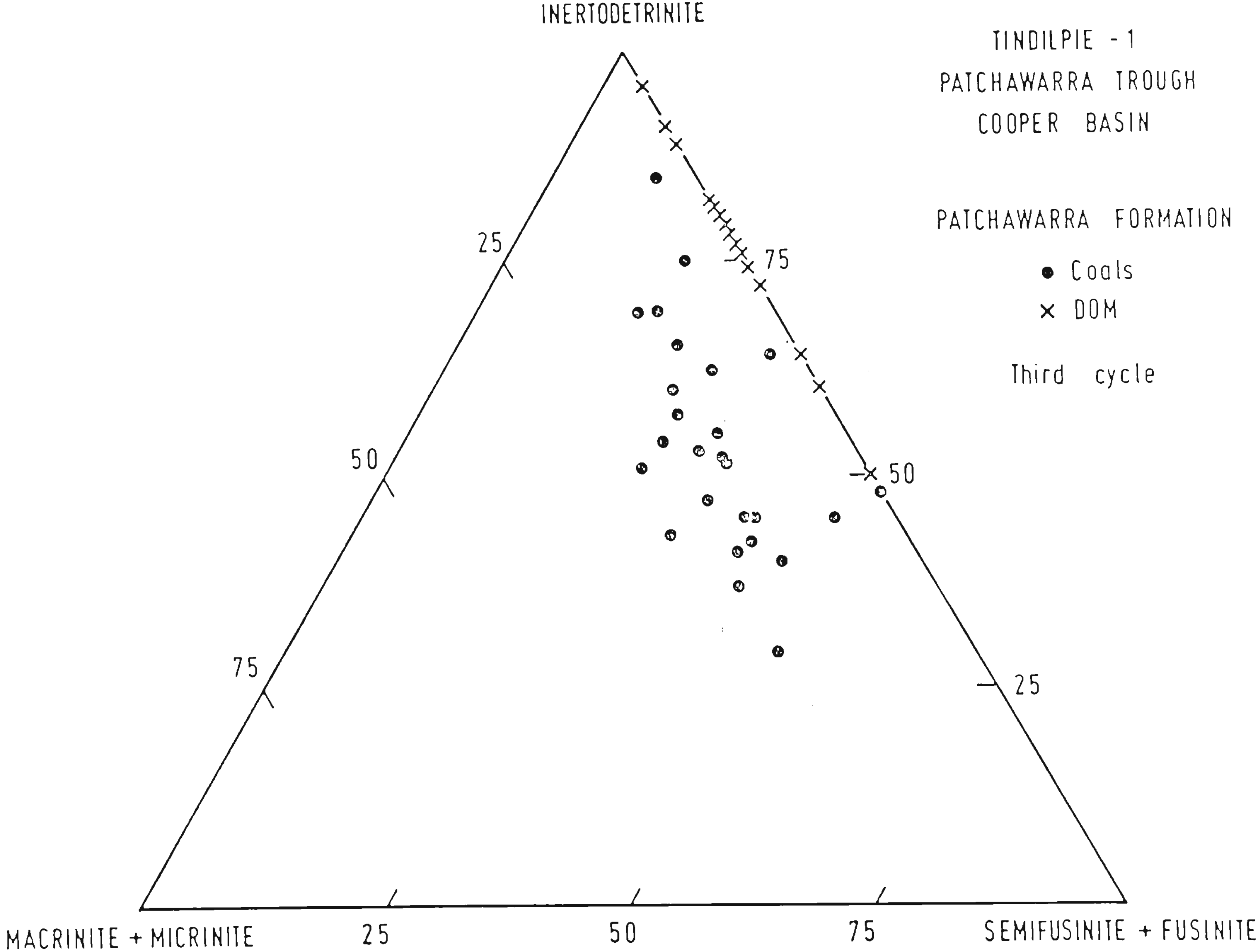


FIG. 4-29 COMPONENTS OF THE INERTINITE MACERAL GROUP

Formation. The components of the inertinite group are plotted in Figs.4.27, 4.28 and 4.29 for the first, second and third cycles, respectively. The apices of the triangles are (i) inertodetrinite, representing broken fragmentary inert material, possibly redeposited debris, (Stach et al., 1975); (ii) semifusinite plus fusinite (semifusinite $\gg$ fusinite), representing the non-humified and more oxidised remains of woody tissue in which the cellular structures are preserved; and (iii) macrinite and micrinite (micrinite DOM is present in one sample only; average volume in coals is 2%; macrinite DOM is present in one sample only; average volume in coals is 2%; macrinite DOM is present in one sample only; average volume in coals is 9%), macrinite representing oxidised gelified plant material for the most part; and micrinite which is believed to be generated in coals from liptinites by Teichmuller, (1974) and/or may be detrital (Shibaoka, 1978). Most micrinite in the Cooper Basin coals clearly comes from vitrinite, possibly even liptinite in vitrinite. The first cycle coals (Fig.4.27) have similar proportions of semifusinite plus fusinite (32-54%) and inertodetrinite (30-57%), with 8-30% macrinite plus micrinite. The DOM is rich in inertodetrinite, 69-92%; with semi-funinite plus fusinite 8-30%.

The second cycle coals (Fig.4.28) are similar to those in the first cycle, with slightly higher proportions of inertodetrinite (29-73%) and less semifusinite (14-54%). The DOM has a high inertodetrinite content (54-100%), but contains a little more semifusinite than first cycle DOM (7-46%). Macrinite plus micrinite range between 0 and 33%.

The third cycle coals contain more inertodetrinite (29-85%) than semi-fusinite plus fusinite (11-52%), and less macrinite plus micrinite (0-24%). The DOM has high inertodetrinite (50-97%) with a semifusinite content similar to that of second cycle DOM (3-50%) (Fig.4.29).

Inertinite is the major component of the Patchawarra Formation coals, and the changes in the types of inertinite represent the changing conditions of deposition and possibly plant types through Patchawarra time. The abundance of semifusinite plus fusinite in the first two cycles may represent dry shrub-covered peatlands, where the bulk of the woody material has accumulated in oxidising conditions, rather than the more reducing conditions which would preserve it as vitrinite. The increase in inertodetrinite in the coal and the higher vitrinite in the third cycle may indicate a wetter environment where more of the woody tissue was protected from oxidation by deeper water. The inertinite deposited in this deeper water could be largely brought in from surrounding more oxidised sites, (hypautochthonous) and be in the fragmentary form of inertodetrinite.

4. (v)c. Murteree Shale

Results of the maceral analyses on coals and DOM are given in Table 4.14 and are plotted in Fig.4.30. The coals have a vitrinite content of 38-64%, exinite 6 to 14% and inertinite between 29 and 64%. The DOM has very low vitrinite, 0-7%, more exinite than the coals, 11-21%, and high inertinite, 76-89%.

Vitrinite plus exinite is plotted against the inertinite in Fig.4.31. The coals have 49-71% vitrinite plus exinite, the DOM 10-24%. The coals contain 12-34% inertodetrinite, the DOM 73-89%. The remaining inertinites comprise 13-28% of the coal, 0-5% of the DOM.

The DOM is displaced from the coals in Fig.4.31 in a way similar to that of the third cycle, Patchawarra Formation, coals and DOM (Fig.4.25).

The components of the exinite group are plotted in Fig.4.32 for the coals and DOM. Sporinite is dominant in one coal, with sporinite equal to

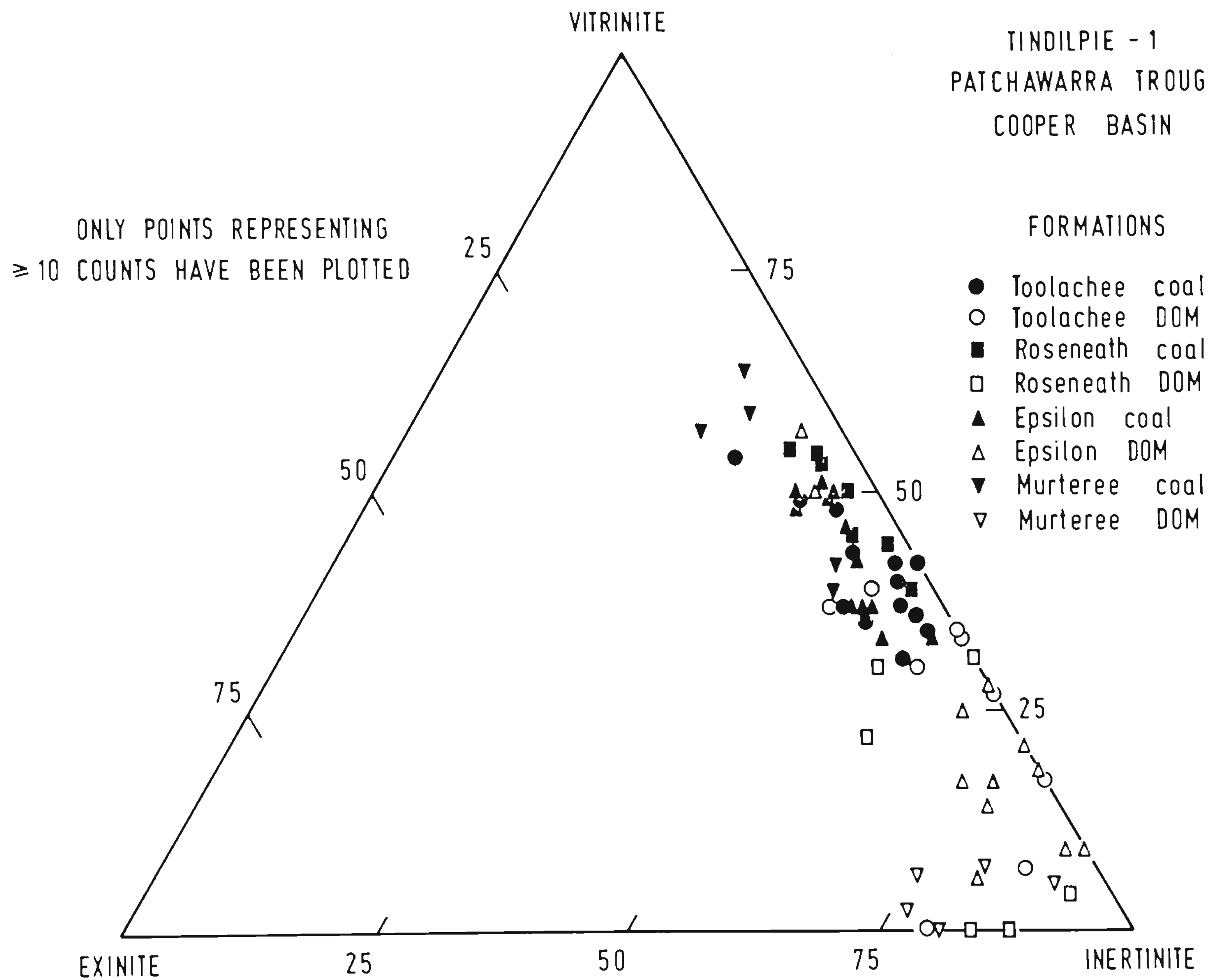
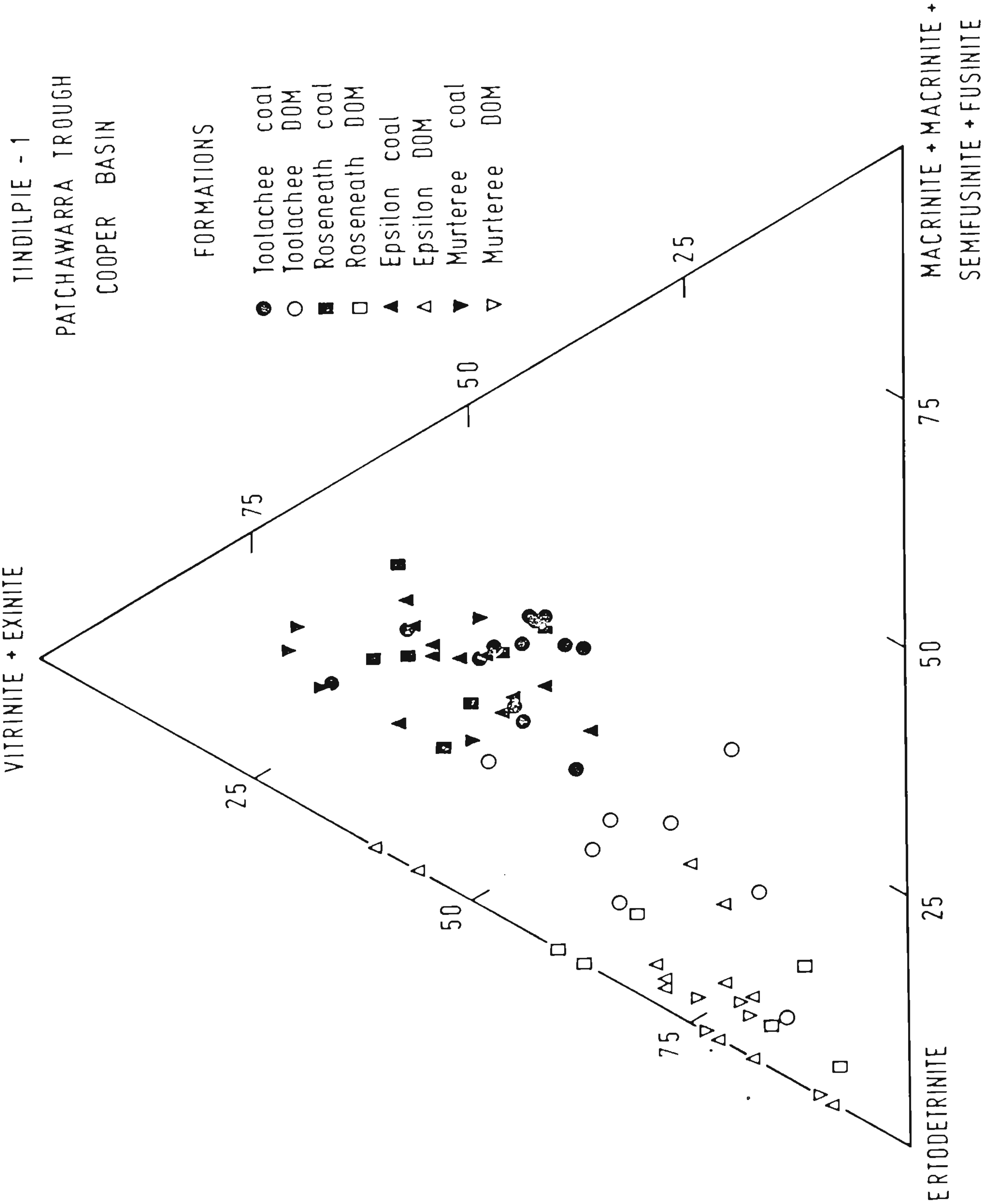


FIG. 4-30 MACERAL COMPOSITIONS OF THE COALS AND DOM


TINDILPIE - 1
PATCHAWARRA TROUGH
COOPER BASIN
FORMATIONS
Toolachee coal
Toolachee DOM
Roseneath coal
Roseneath DOM
Epsilon coal
Epsilon DOM
Murteree coal
Murteree DOM
VITRINITE + EXINITE
INERTODETRINITE
MACRINITE + MACRINITE + SEMIFUSINITE + FUSINITE
25
50
75
25
50
75
25
50
75

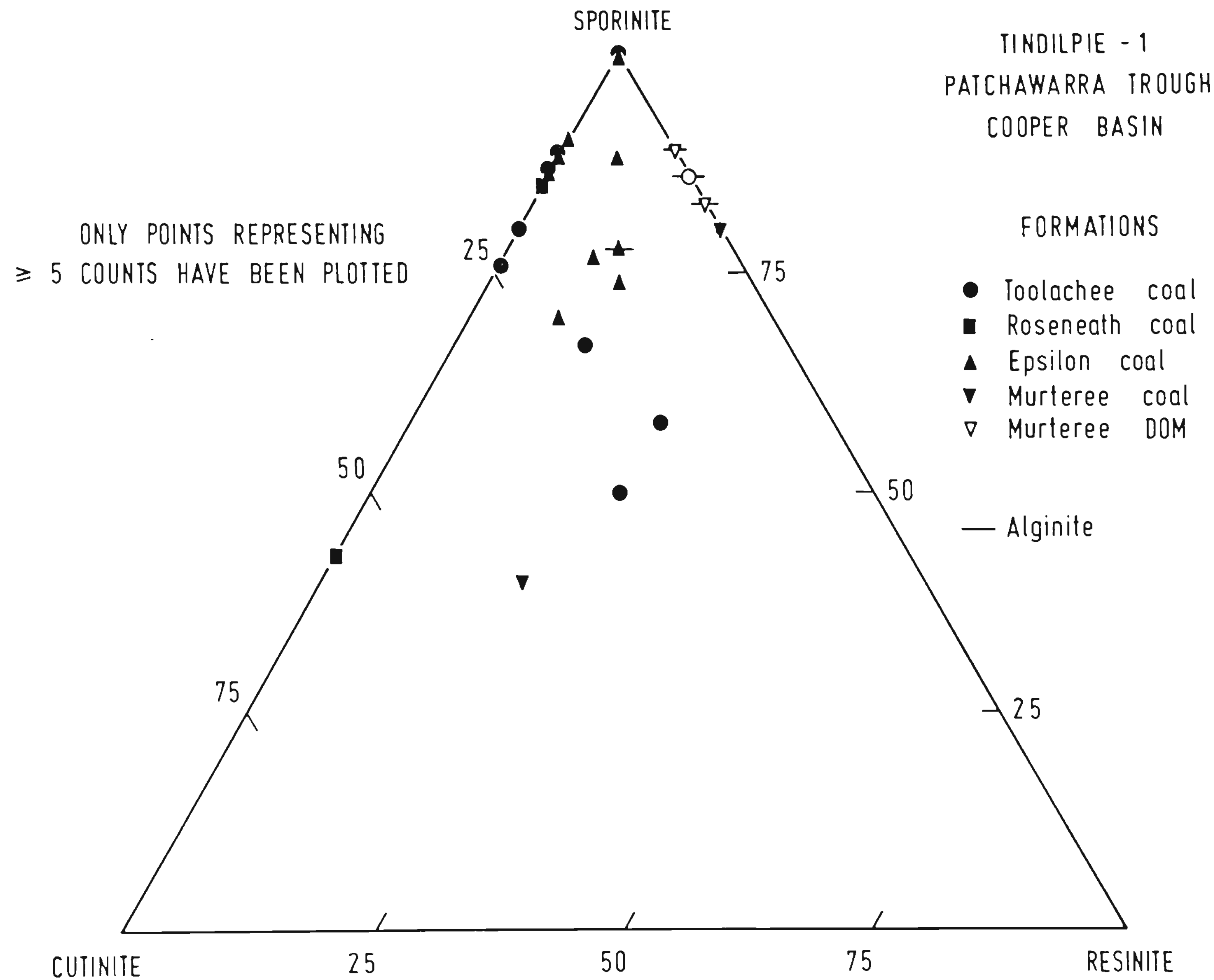


FIG. 4-32 COMPONENTS OF THE EXINITE MACERAL GROUP

cutinite in the other. Sporinite is more than 80% of the exinite DOM: alginite DOM is present (see Fig.4.14).

The inertinite components of coals and DOM are plotted in Fig.4.33. Inertodetrinite predominates in the DOM, but some coals contain a high proportion of semifusinite as well as inertodetrinite.

4. (v)d. Epsilon Formation

Results of the maceral analyses are given in Table 4.13 and are plotted in Fig.4.30. The coals have 34-51% vitrinite, 3-9% exinite and 42-64% inertinite. The DOM has 7-57% vitrinite, 0-13% exinite and 40-91% inertinite.

On a plot of vitrinite plus exinite, the coals are generally well separated from the DOM (Fig.4.31). The coals have 36-58% vitrinite plus exinite, the DOM, 8-28%; 16-40% inertodetrinite, whilst the DOM has 59-92%; and 13-27% remaining inertinites, DOM 0-16%; except for two samples of DOM which have 56-61% vitrinite plus exinite, 39-44% inertodetrinite and 0 remaining inertinites.

As with the Murteree Formation, DOM is displaced steeply from the Epsilon Formation coals, except for two samples, which are displaced upwards.

The components of the exinite group in the coals are plotted in Fig.4.32. Sporinite is dominant in the coal; an occurrence of alginite is marked in Fig.4.14. The DOM contains insufficient exinite for meaningful subdivision.

Inertodetrinite is the dominant inertinite maceral, especially in the DOM (Fig.4.33). Some coals contain more semifusinite than inertodetrinite. Both coals and DOM are similar in type to those of the Murteree Shale.

4. (v)e. Roseneath Shale

Results of the maceral analyses of the organic matter are in Table 4.12. The coals are similar in petrographic composition to those in the Epsilon and Murteree Formations, with 37-55% vitrinite, 2-8% exinite and 40-55% inertinite (Fig.4.30). The DOM has 0-32% vitrinite, 0-16% exinite and 60-92% inertinite.

The Roseneath DOM is displaced steeply towards the inertinite apex from the coals. In the plot of vitrinite plus exinite against the inertinite (Fig.4.32), the coals have 41-61% vitrinite plus exinite, DOM 8-40%; 12-33% inertodetrinite in the coal, 60-88% in the DOM; with 13-30% remaining inertinites in coal, 0-12% in DOM.

Both sporinite and cutinite occur in the coals (Fig.4.32). The DOM contains insufficient exinite for meaningful splitting into the sub-macerals.

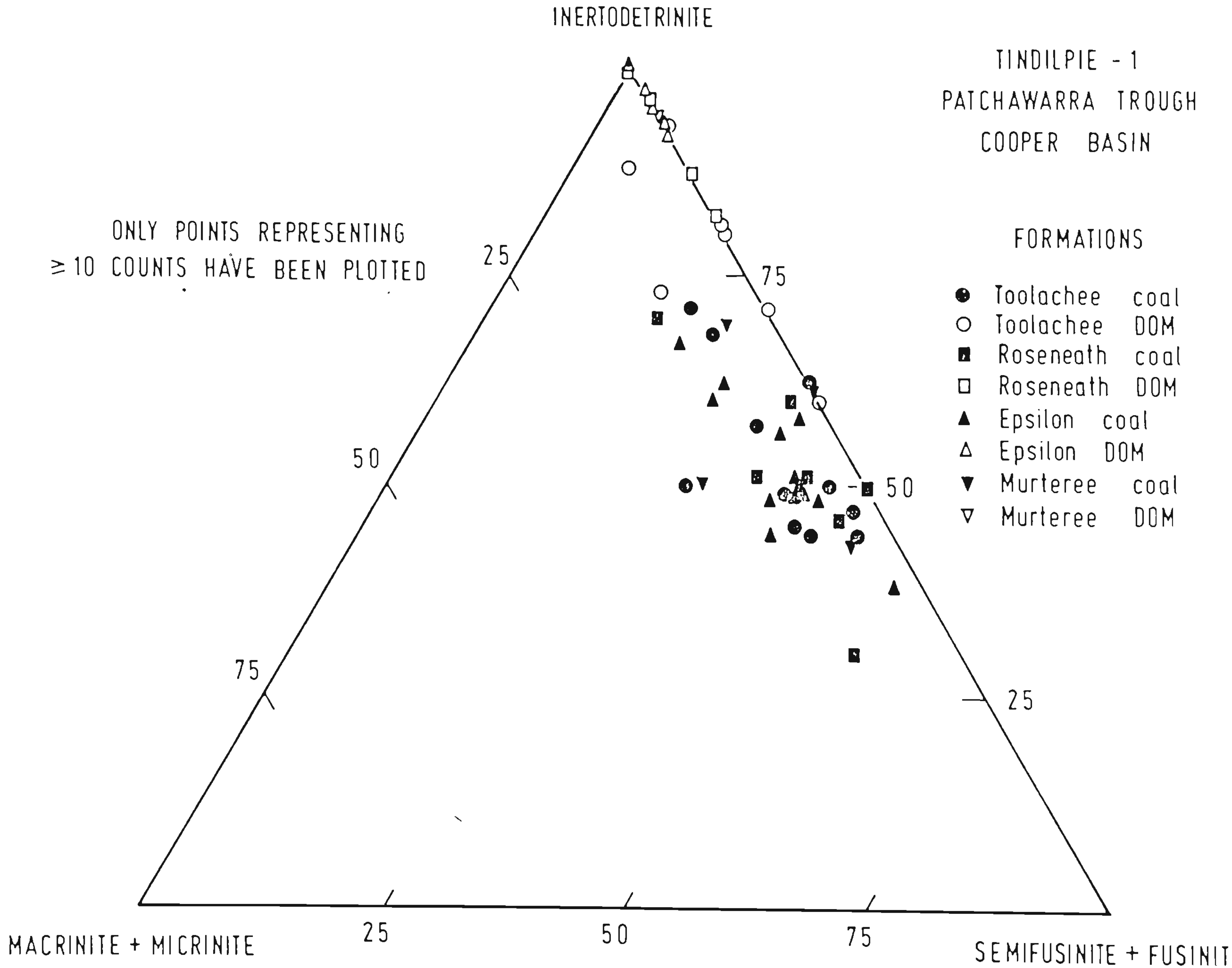
Inertodetrinite and semifusinite are abundant in the coals and inertodetrinite is dominant in the DOM (Fig.4.33).

4. (v)f. Toolachee Formation

The Toolachee Formation is Upper Permian in age, whereas the underlying formations so far dealt with are Lower Permian in age.

Results of the maceral analyses are in Table 4.11, and are plotted in Fig.4.30. The coals have 30-54% vitrinite, 0-12% exinite and 34-62% inertinite. The DOM has 0-38% vitrinite, 0-20% exinite and 52-87% inertinite.

Vitrinite plus exinite against inertinite (Fig.4.31) show that these Toolachee coals and DOM plot more closely together than those in the Murteree, Epsilon and Roseneath Formations. The coals have 38-66% vitrinite plus exinite; the DOM, 13-48%; inertodetrinite, 19-43% in coals,


INERTODETRINITE
TINDILPIE - 1
PATCHAWARRA TROUGH
COOPER BASIN
ONLY POINTS REPRESENTING
≥ 10 COUNTS HAVE BEEN PLOTTED
FORMATIONS
Toolachee coal
Toolachee DOM
Roseneath coal
Roseneath DOM
Epsilon coal
Epsilon DOM
Murteree coal
Murteree DOM
25
50
75
25
50
75
25
50
75
MACRINITE + MICRINITE
SEMIFUSINITE + FUSINITE

37-80% in the DOM; remaining inertinites, 14-33% in coals, 6-30% in DOM.

They are similar to the plot of the first cycle coals and DOM in the Patchawarra Formation, whereas the other three formations are more like the third cycle, Patchawarra Formation.

Sporinite is the dominant exinite in the coals; the DOM has insufficient exinite for meaningful subdivison and plotting (Fig.4.32).

In the coals, inertodetrinite is as abundant as, or more abundant than semifusinite. Inertodetrinite is the most abundant inertinite maceral in the DOM (Fig.4.33).

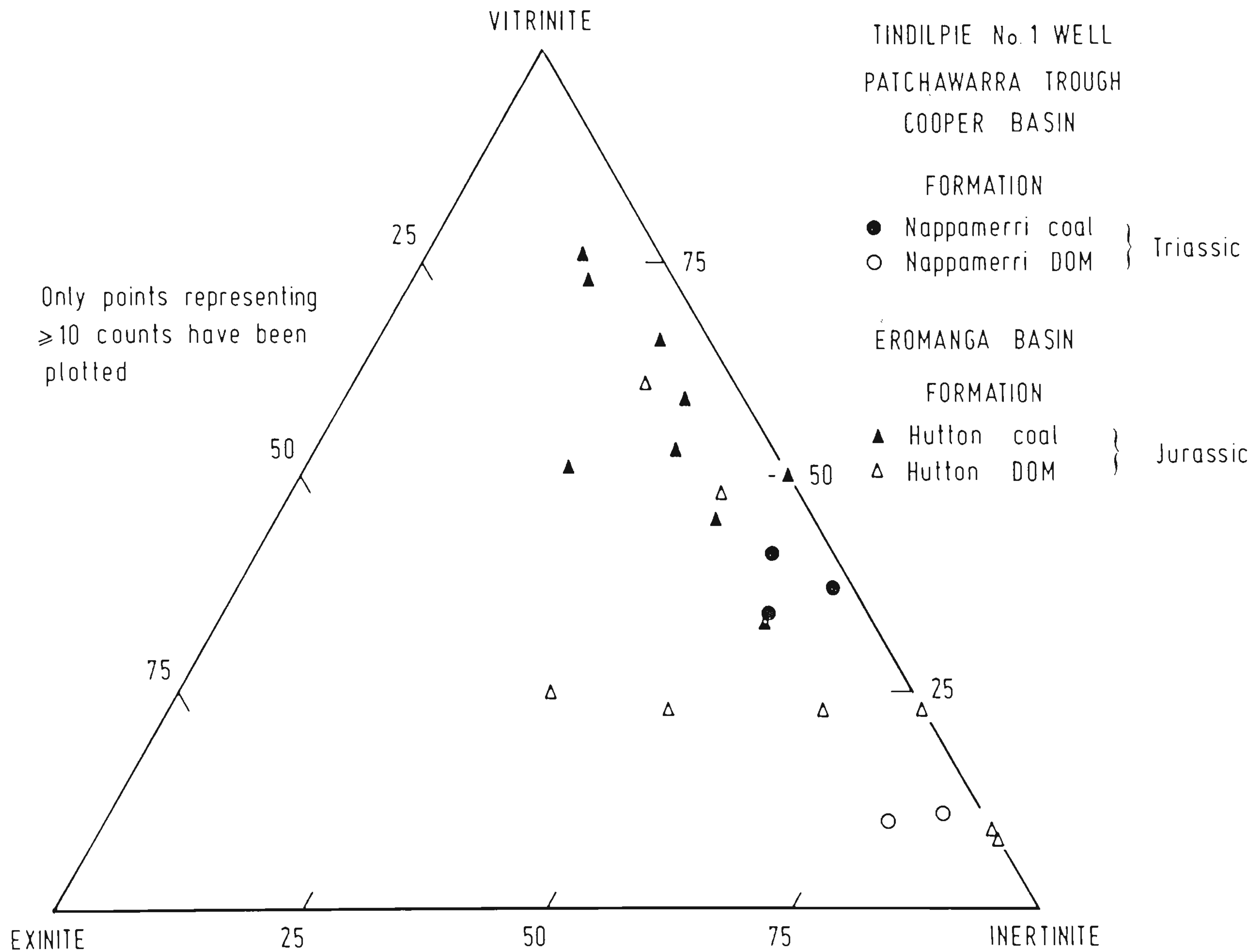
4. (v)g. Nappamerri Formation

The Nappamerri Formation is Triassic in age and forms part of the Cooper Basin sequence. Coals from the Nappamerri Formation have 34-40% vitrinite, 2-10% exinite and 53-62% inertinite (Fig.4.34, Table 4.10). The DOM has 10-11% vitrinite, 4-10% exinite and 80-85% inertinite.

Vitrinite plus exinite are plotted against the inertinites in Fig.4.35. The DOM is displaced steeply downwards from the coals. Coals have 39-67% vitrinite plus exinite, DOM 15-38%; inertodetrinite is 19-31% of the coals, 70-81% of the DOM; coals contain 30-34% remaining inertinites, the DOM, 4-10%.

Fig.3.36 shows the components of the exinite maceral group. The apices of the triangle have been changed from those plotted for Permian coals to accommodate the increasing proportions of resinite and suberinite in the younger coals. Only one coal has sufficient exinite for plotting, and it has dominant sporinite plus cutinite.

The coals contain slightly more semifusinite plus fusinite than inertodetrinite; inertodetrinite is the main component of the DOM (Fig.4.37).


TINDILPIE No. 1 WELL
PATCHAWARRA TROUGH
COOPER BASIN
FORMATION
Nappamerri coal
Nappamerri DOM
Triassic
EROMANGA BASIN
FORMATION
Hutton coal
Hutton DOM
Jurassic
VITRINITE
EXINITE
INERTINITE
25
50
75
Only points representing ≥10 counts have been plotted

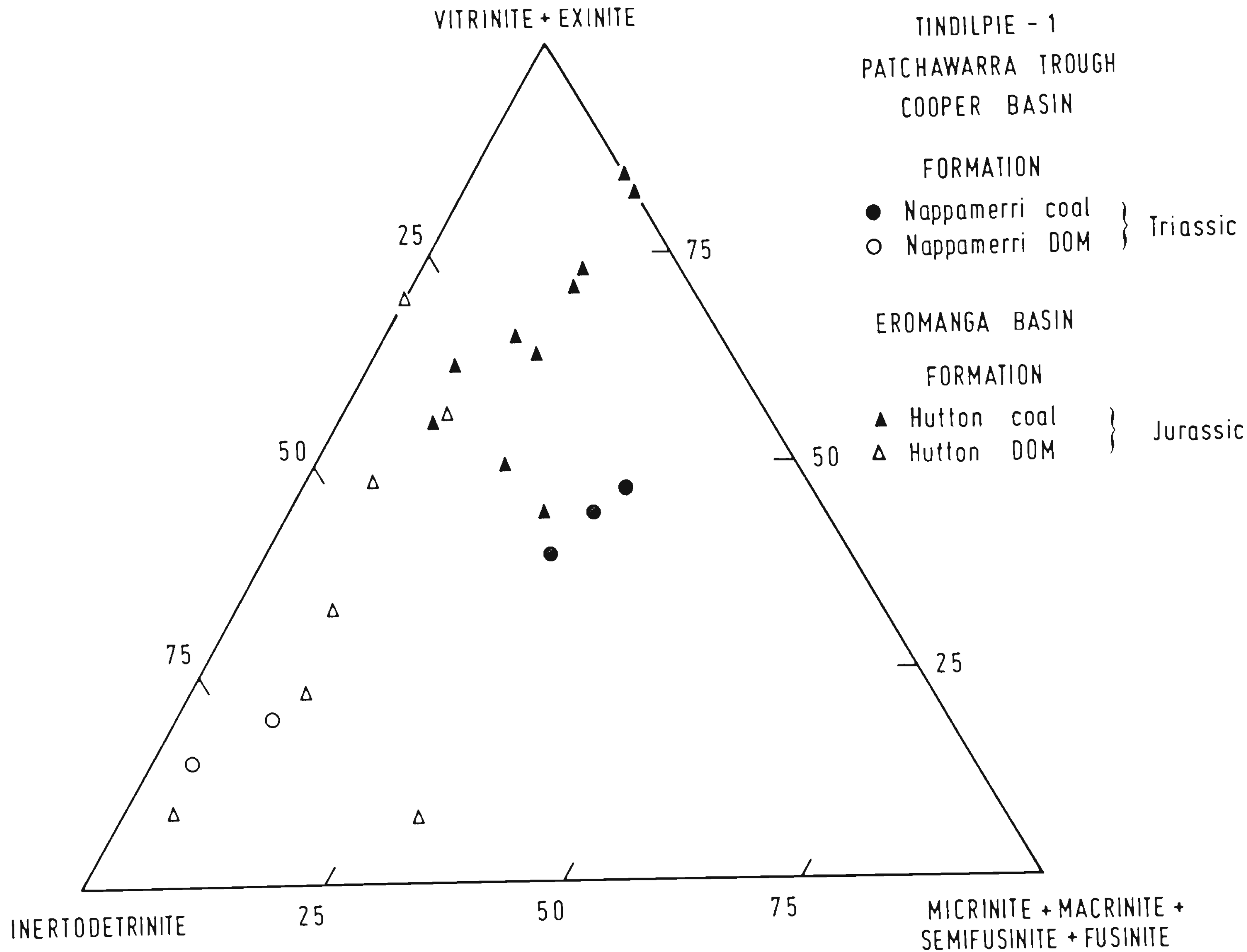


FIG. 4-35 VITRINITE + EXINITE (LIKELY SOURCES OF HYDROCARBONS) PLOTTED AGAINST INERTINITES

4. (v)h. Hutton Formation

The Jurassic Hutton Formation is part of the Jurassic-Cretaceous Eromanga Basin overlying the Permo-Triassic Cooper Basin. The maceral compositions of its coals and DOM are plotted in Fig.4.34, and given in Table 4.9. The coals have 33-76% vitrinite, 0-22% exinite and 17-55% inertinite. The DOM has 8-61% vitrinite, 0-38% exinite and 38-92% inertinite.

The DOM is displaced steeply towards inertodetrinite from the coals on the plot of vitrinite plus exinite against inertinite (Fig.4.35). The coals contain 44-84% vitrinite plus exinite; the DOM, 8-70%. Inertodetrinite varies between 0 and 36% in the coals; 31 and 86% in the DOM. The remaining inertinites are 9-27% of the coals; 0-32% of the DOM.

Sporinite and cutinite are the dominant exinites in the coals; suberinite and resinite occur in approximately equal proportions. Both samples of DOM which have been plotted contain a high proportion of sporinite plus cutinite, and contain alginite, but not resinite (Fig.4.36).

The coals contain approximately equal proportions and inertodetrinite and semifusinite plus fusinite, as well as a quite high amount of micrinite plus macrinite (mainly micrinite), (Fig.4.37, Table 4.9). The DOM contains a high proportion of inertodetrinite, 66-100%.

4. (v)i. Microlithotypes of seams, all formations

The microlithotype compositions of the seams from the Permian, Triassic and Jurassic coals have been plotted in Fig.4.38. All seams except one from the Hutton Formation contain between 8 and 48% vitrite plus clarite (Tables 4.18 to 4.24).

Patchawarra Formation, first cycle seams all fall in the low (8-30%) vitrite plus clarite area of the triangle in Fig.4.38, with either high

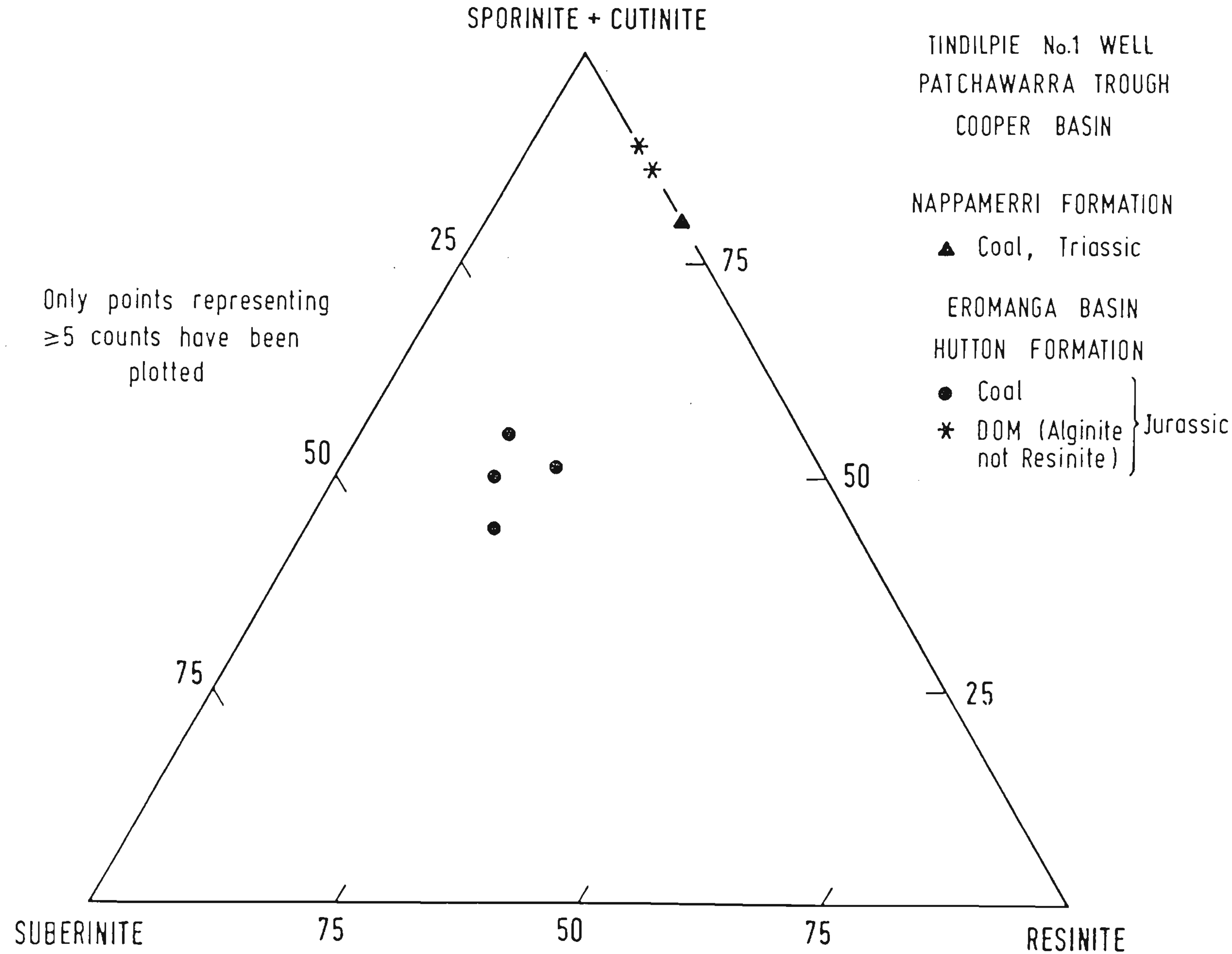


FIG 4·36. COMPONENTS OF THE EXINITE MACERAL GROUP IN THE NAPPAMERRI AND HUTTON FORMATIONS intermediates (28-39%) or high durite plus inertite (31-59%). The second cycle coals are similar (11-23% vitrite plus clarite, 25-48% intermediates, 40-62% durite plus inertite). Third cycle coals contain more vitrite plus clarite (14-44%) and more intermediates (13-49%), on average, than the first two cycles.

Microlithotypes are available for only one seam from the Murteree Shale, and it has a low vitrite plus clarite, 34%, and high intermediates content 47% (Fig.4.38), with 19% durite plus inertite.

Coals from the Epsilon Formation (26-32% vitrite plus clarite, 43-49% intermediates, 21-27% durite plus inertite) and the Roseneath Shale (34-37% vitrite plus clarite, 32-47% intermediates, 16-33% durite plus inertite) are similar in microlithotype composition to the coal from the Murteree Shale, (Fig.4.38).

Toolachee Formation coals have 15-33% vitrite plus clarite contents, with 32-49% intermediates and 18-52% durite plus inertite (Fig.4.38).

The one Nappamerri Formation coal has 26% vitrite plus clarite, 18% intermediates and 56% durite plus inertite. The Hutton Formation coals have 38-52% vitrite plus clarite, 18-35% intermediates and 13-34% durite plus inertite (Fig.4.38).

4. (vi) Discussion of Results

The average volumes of DOM in the samples selected from Tindilpie 1 are:

Hutton Formation	2.2%
Nappamerri Formation	1.0%
Toolachee Formation	2.0%
Roseneath Shale	2.1%
Epsilon Formation	2.8%
Murteree Shale	3.8%

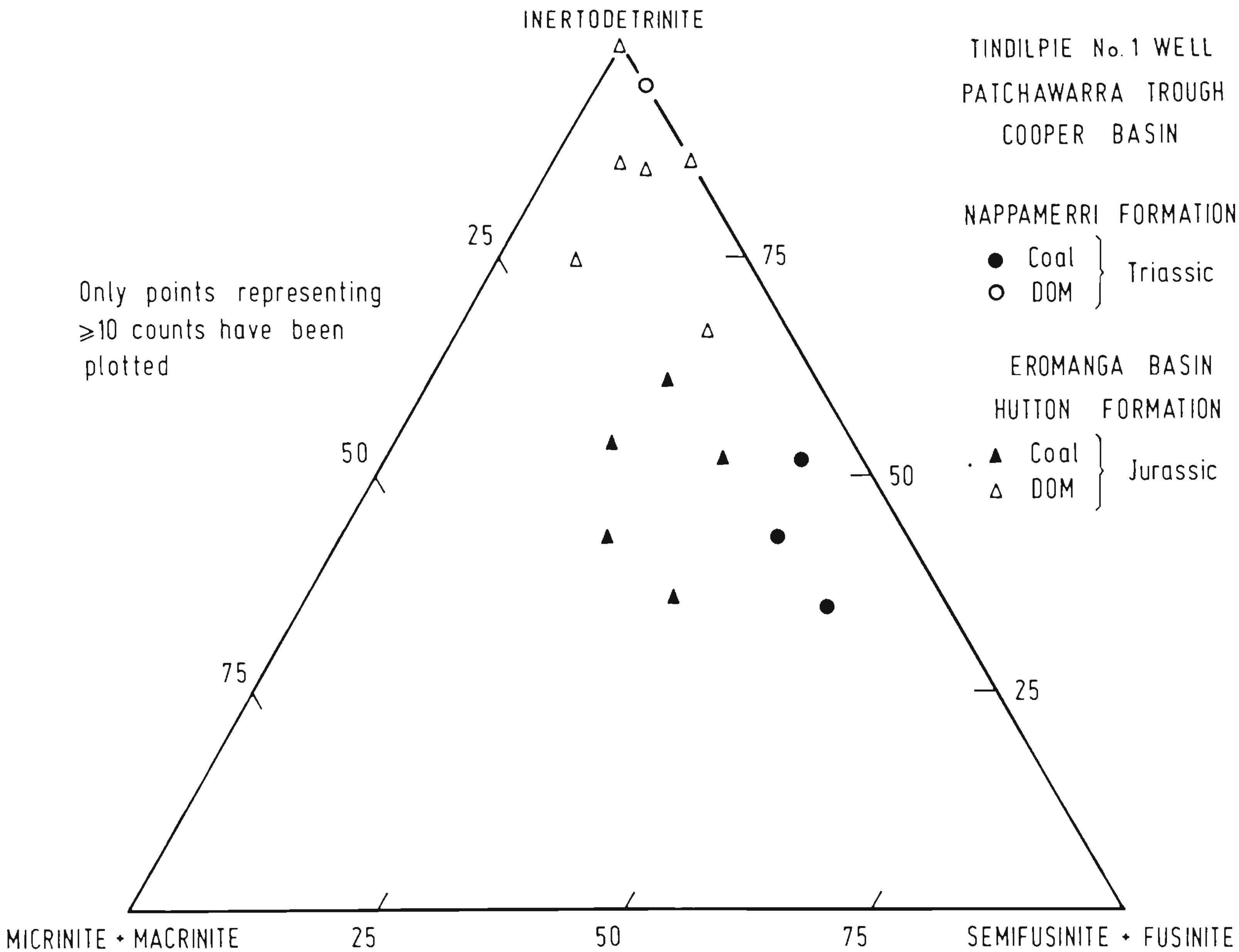


FIG. 4-37 COMPONENTS OF THE INERTINITE MACERAL GROUP IN THE NAPPAMERRI AND HUTTON FORMATIONS

Patchawarra Formation	Third cycle	4.3%
	Second cycle	3.4%
	First cycle	2.0%
Tirrawarra Formation		0.8%
Merrimelia Formation		0.6%

The third cycle of the Patchawarra Formation (above the Malabine Coal) contains 5.50% DOM in Mudrangie 1 and 4.27% in Tindilpie 1 in the selected samples. This section of the sedimentary sequence contains the most DOM, followed by the Murteree Shale, 5.00% in Mudrangie 1, 3.80% in Tindilpie 1.

As in Mudrangie 1, all of the DOM is inertinite-rich. However, third cycle Patchawarra Formation and Murteree Shale DOM contain more exinite than does DOM from the other formations (Figs.4.22 and 4.30). Alginite occurs in almost every sample in these two sequences also (Figs.4.14, 4.15). The coal seams associated with this DOM tend to have relatively high vitrite plus clarite and intermediates contents.

Omitting the Tirrawarra Sandstone and Merrimelia Formation which contain very little organic matter of any kind, the formations with the least DOM are, in order, the Nappamerri (1%), Toolachee (2%) and Patchawarra Formations, first cycle (2%). The coals in these formations associated with the DOM have low vitrite plus clarite and high durite plus inertite contents (Fig.4.38).

It may be that the conditions which lead to the formation of coals which are durite plus inertite-rich are least favourable for the accumulation and/ or preservation of DOM. Fig.4.39 shows a trend in this direction for the organic matter in the Patchawarra Trough, although the third and second cycles do not fit the general trend.

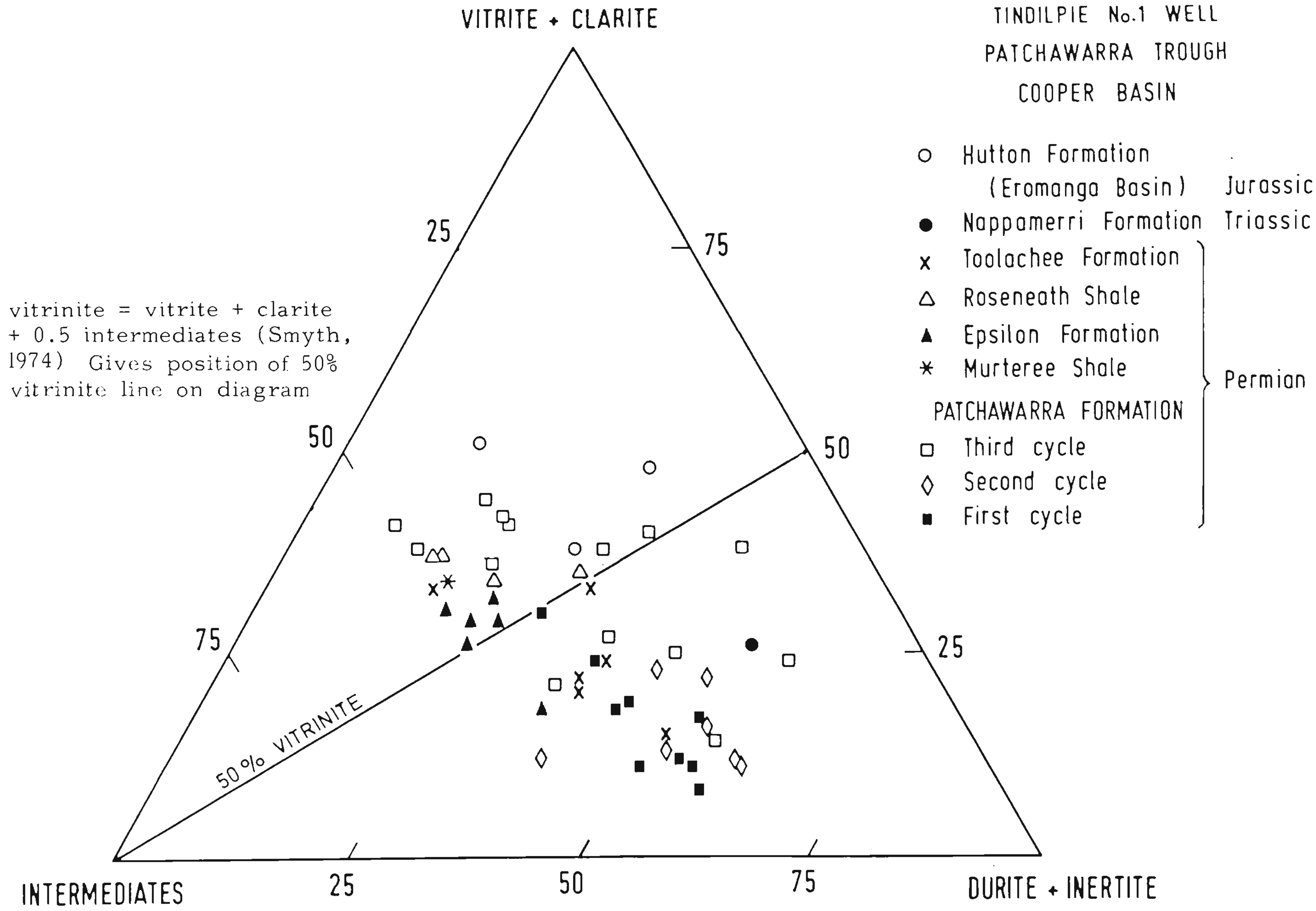


FIG 4-38. MICROLITHOTYPE COMPOSITIONS OF COALS IN JURASSIC, TRIASSIC AND PERMIAN FORMATIONS

◇ Hutton Formation

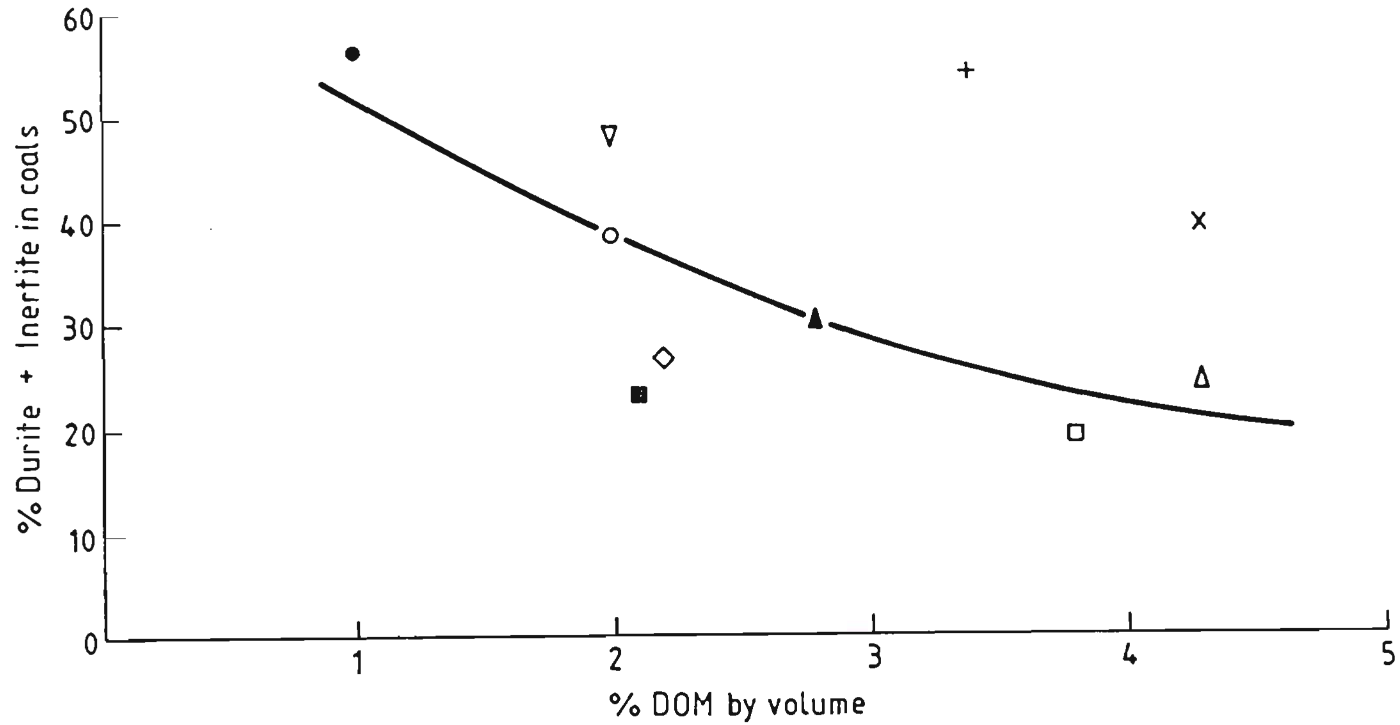


FIG. 4·39 RELATIONSHIP BETWEEN DURITE PLUS INERTITE CONTENT OF COALS AND VOLUME OF DOM IN ASSOCIATED SEDIMENTARY ROCKS IN THE PATCHAWARRA TROUGH, COOPER BASIN

● Nappamerri Formation (Triassic)
○ Toolachee Formation (U. Permian)
■ Roseneath Shale (L. Permian)
▲ Epsilon Formation (L. Permian)
□ Murteree Shale (L. Permian)

Patchawarra Formation (L. Permian)
× Third cycle
Δ Third cycle (Stage 4 only)
+ Second cycle
∇ First cycle

More precise correlations between the macerals in coals and DOM and coal microlithotypes have been attempted using statistical tests. These are described in the next section.

4. (vii) Summary

1. DOM in the Permian sequence in Mudrangie 1 and Tindilpie 1 wells is inertinite-rich.. The highest proportion of exinite DOM occurs in the Patchawarra Formation, third cycle in Tindilpie 1, and the Murteree Shale. The third cycle incorporates the upper part of Stage 3'. Lower Stage 4, and Upper Stage 4' of the Patchawarra Formation.

2. The Permian coals all have low to medium vitrite plus clarite contents, with high intermediates and/or durite plus inertite contents. The coals with highest vitrite plus clarite contents are from the third cycle, Patchawarra Formation, Murteree Shale, Epsilon Formation and Roseneath Shale.

3. The above findings are in agreement with those for the Fly Lake - Brolga area of the Patchawarra Trough.

4. The greatest volume of DOM occurs in the Patchawarra Formation, above the Malabine seam in Mudrangie 1; the third cycle in Tindilpie 1. On the basis of quantity and type, this section of the Permian sequence contains the sediments with the best potential for hydrocarbon generation.

5. THE CORRELATION OF DISPERSED ORGANIC MATTER WITH MACERALS AND MICROLITHOTYPES IN ASSOCIATED COALS

5. (i) Introduction

Results of microscopic studies of coals and DOM in six wells of the Patchawarra Trough have shown:

(a) a relationship between exinite DOM and coals highest in vitrite plus clarite;

(b) a possible relationship between vitrinite DOM and high intermediates in associated coals;

(c) the location of the most exinite-rich DOM is the upper part of the Patchawarra Formation.

Results of petrographic analyses of DOM and coals from Mudrangie 1 and Tindilpie 1 are in numerical form. These data are suitable for statistical testing.

5. (ii) Statistical Testing

Because the data are in percentage form, an internal correlation exists amongst the vitrinite, exinite and inertinite in the coals, amongst these macerals in the DOM, as well as amongst the microlithotypes in the coals. It is necessary to correct for this internal relationship, due to the closed nature of the data systems within groups to determine statistically significant relationships between groups of associated coals and DOM.

In view of the problem arising from the form of the data, advice on its solution was sought from a statistician, Dr. Murray Cameron of the CSIRO Division of Mathematics and Statistics. Dr. Cameron confirmed the expectation that the correlation of these types of data was one requiring a high level of statistical experience and expertise to obtain meaningful results.

The method he proposed for the data was one involving testing for dependence between the macerals and ratios of macerals within each group, for example,

$$V_c \text{ and } \frac{I_c}{(1-V_c)} \qquad \text{and, } I_c \text{ and } \frac{V_c}{(1-I_c)}$$

where V_c = % vitrinite in coal $\quad V_D$ = % vitrinite DOM

E_c = % exinite in coal $\quad E_D$ = % exinite DOM

I_c = % inertinite in coal $\quad I_D$ = % inertinite DOM

and V + C = % vitrite plus clarite in coal

In = % intermediates in coal

D + I = % durite plus inertite in coal

If no evidence of dependence in either case is found, then it is said that no association exists between V_c and I_c.

A significant correlation existing between V_c and V_D together with a strong (negative) correlation between V_D and I_D may induce a spurious correlation between V_c and I_D or possibly mask a true one, because of the constraint

$$V_D + E_D + I_D = 1 \text{ (or 100\%)}$$

To overcome this potential bias the correlations between

$$V_c \text{ and } \frac{I_D}{E_D}, \; I_D \text{ and } \frac{V_c}{Ec}$$

must be considered.

Details of the method used are described in Cameron and Smyth (in prep.) and are presented in Appendix 5. Basically the method employs Kendall's τ. Kendall's τ is the difference between the probability that high values of X are associated with high values of Y and the probability that high values of X are associated with low values of Y. τ does not depend on the magnitudes of observations, but on relative values within the samples.

5 (iii) Results for Mudrangie 1

Results of petrographic analyses of coals and DOM from the formations in Mudrangie 1 were such that those from the Patchawarra Formation are the only ones sufficiently numerous for testing. The variations in coal type, as expressed by V_c, E_c, I_c and V + C, In, D+I, were tested against the variations in DOM type as expressed by V_D, E_D, I_D.

Computer printouts for Mudrangie 1 are presented as Tables 5.1 to 5.3. In these tables, the numbers 1 to 9 in the first two columns represent the following:

1 = V_c	4 = V_D	7 = V + C
2 = E_c	5 = E_D	8 = In
3 = I_c	6 = I_D	9 = D + I

nobs = number of pairs used to estimate the correlation;

tau = the correlation;

sd = approximate standard deviation of tau (τ)

$Z = \frac{tau}{sd}$, is a normal variable with mean zero and variance one, if the variables (1/3 and 2/1, say) are uncorrelated. If $| z | > 1.96$, then the correlation is significant at the 5% level (Daniel, 1978).

The correlations of interest are those involving DOM, i.e. the numbers 4,5,6 in the correlation tables.

For the whole of the Patchawarra Formation no significant correlations have emerged between DOM macerals and coal macerals (1,2,3) or microlithotypes (7,8,9) in this particular testing (Table 5.1). Nor are any correlations evident between ratios of DOM macerals and coal macerals and microlithotypes (Tables 5.2, 5.3).

Significant correlations appear between coal macerals and microlithotypes, as would be expected.

However, the Patchawarra Formation data were divided into two groups: (1) the Malabine seam and below; and (2) above the Malabine seam.

Results of the testing of the Malabine seam and below are given in Tables 5.4 to 5.6. None of these correlations is significant either.

The Patchawarra Formation, above the Malabine seam, results are given in Tables 5.7 to 5.9. In Table 5.7, V_D is correlated significantly with V_c.

In summary, the only significant correlation found for Mudrangie 1 results, is that between the vitrinite in coal and vitrinite DOM in the stratigraphic section of the Patchawarra Formation above the Malabine seam. (≡ Upper Stage 3', Lower Stage 4 and Upper Stage 4' of Thornton, 1979).

The above findings are disappointing, but expected, in view of the overall inertinite-rich nature of both coals and DOM, the absence of exinite in many samples, and the lack of vitrite plus clarite-rich coals.

As vitrinite as well as exinite is considered to have some potential as a source of hydrocarbons (Saxby, 1978), the Mudrangie 1 data were regrouped into the parameters vitrinite plus exinite = $V_c + E_c$ (= 1 in tables) inertodetrinite = Id_c (=2) and the remaining inertinites and RI_c (=3) for coals; and

$V_D + E_D$ = 4 vitrinite plus exinite DOM

Id_D = 5 inertodetrinite DOM

RI_D = 6 remaining inertinites DOM

These data were tested as before and results are given in Tables 5.10 to 5.12 for the Patchawarra Formation.

The significant correlations found are between

$\frac{V_D + E_D}{RI_D}$ and $V_c + E_c$ (Table 5.11) and

$$\frac{V_D + E_D}{RI_D} \text{ and } \frac{Id_c}{V_c + E_c} \quad \text{(negative)} \quad \text{(Table 5.12)}$$

$$\frac{V_D + E_D}{RI_D} \text{ and } \frac{V_c + E_c}{RI_c}$$

The two sections of the Patchawarra Formation, Malabine seam and below, and above the Malabine seam, yielded few significant correlations. For the Malabine seam and below (Tables 5.13 to 5.15) the only significant correlations found is:

$$\frac{Id_D}{V_D + E_D} \text{ and } RI_c \quad \text{(Table 5.14)}$$

Significant correlations found in the Patchawarra Formation sequence above the Malabine seam, (Tables 5.16 to 5.18) are:

$$\frac{Id_D}{V_D + E_D} \text{ and } Id_c \quad \text{(Table 5.17)}$$

$$\frac{Id_D}{V_D + E_D} \text{ and } \frac{Id_c}{V_c + E_c} \quad \text{(Table 5.18)}$$

$$\frac{Id_D}{V_D + E_D} \text{ and } \frac{Idc}{RI_c}$$

In summary, significant correlations found in the Patchawarra Formation, if it is considered in two sections, are:

i) $\frac{\text{vitrinite plus exinite DOM}}{\text{inertinite (remaining) DOM}}$ correlates with (a) vitrinite plus exinite in the coal and (b) $\frac{\text{vitrinite plus exinite in coal}}{\text{inertinite (remaining) in coal}}$

ii) $\frac{\text{vitrinite plus exinite DOM}}{\text{inertinite (remaining) DOM}}$ correlates negatively with $\frac{\text{inertodetrinite in coal}}{\text{vitrinite plus exinite in coal}}$

In the section of the Patchawarra Formation up to and including the

Malabine seam:

$\frac{\text{inertodetrinite DOM}}{\text{vitrinite + exinite DOM}}$ correlates with inertinite (remaining) in coal,

and in the section above the Malabine seam

$\frac{\text{inertodetrinite DOM}}{\text{vitrinite plus exinite DOM}}$ correlates with inertodetrinite in coal

$\frac{\text{inertodetrinite DOM}}{\text{vitrinite plus exinite DOM}}$ correlates with $\frac{\text{inertodetrinite in coal}}{\text{vitrinite plus exinite in coal}}$

$\frac{\text{inertodetrinite DOM}}{\text{vitrinite plus exindite DOM}}$ correlates with $\frac{\text{inertodetrinite in coal}}{\text{inertinite (remaining) in coal}}$

For the Patchawarra Formation as a whole, the vitrinite plus exinite content of the coal, is positively correlated with the content of these macerals in DOM. Also the ratios of inertodetrinite to vitrinite plus exinite in the coal is negatively correlated with the ratio of vitrinite plus exinite to inertinite (remaining) in the DOM.

Below the Malabine seam, the more inertinite (remaining) in the coal, the higher the proportion of inertodetrinite to vitrinite plus exinite in the DOM.

Above the Malabine seam, the more inertodetrinite in the coal, the more inertodetrinite compared with vitrinite plus exinite in the DOM; the more inertodetrinite in the coal compared with inertinite (remaining), the more inertodetrinite compared with vitrinite plus exinite in the DOM.

A simplication of the above would seem to be that as vitrinite plus exinite increases in coals, the vitrinite plus exinite in the associated DOM increases. As inertinites increase in coals, vitrinite plus exinite in associated DOM decreases.

Vitrinite is the major component of 'vitrinite plus exinite' in Mudrangie 1. Vitrinite DOM is most likely to be found associated with coals containing relatively greater proportions of vitrinite.

5 (iv) Results for Tindilpie 1

The data from Tindilpie 1 are voluminous, but even so, only the Patchawarra Formation has yielded sufficient numbers of results for statistical testing.

Results for the Patchawarra Formation are given in Tables 5.19 to 5.21. The relationships from Table 5.19 are shown on Fig.5.1. Significant correlations are:

1. E_D correlates with V_c (Table 5.19)
2. E_D " " E_c
3. E_D " " I_c (negatively)
4. E_D " " V+C
5. E_D " " D+I (negatively)
6. I_D " " V_c (negatively)
7. I_D " " I_c
8. I_D " " V+C (negatively)
9. I_D " " D+I
10. E_D " " $\frac{E_c}{V_c}$ (Table 5.20)
11. E_D " " $\frac{V_c}{I_c}$
12. E_D " " $\frac{E_c}{I_c}$
13. E_D " " $\frac{V+C}{D+I}$
14. E_D " " $\frac{In}{D+I}$
15. I_D " " $\frac{V_c}{I_c}$ (negatively)
16. I_D " " $\frac{E_c}{I_c}$ (negatively)
17. I_D " " $\frac{V+C}{D+I}$ (negatively)

18. I_D correlates with $\frac{In}{D+I}$ (negatively)

19. V_c " " $\frac{E_D}{V_D}$

20. V_c " " $\frac{V_D}{I_D}$

21. V_c " " $\frac{E_D}{I_D}$

22. E_c " " $\frac{E_D}{V_D}$

23. E_c " " $\frac{E_D}{I_D}$

24. I_c " " $\frac{E_D}{V_D}$ (negatively)

25. I_c " " $\frac{V_D}{I_c}$ (negatively)

26. I_c " " $\frac{E_D}{I_D}$ (negatively)

27. V+C " " $\frac{E_D}{V_D}$

28. V+C " " $\frac{E_D}{I_D}$

29. D+I " " $\frac{E_D}{V_D}$ (negatively)

30. D+I " " $\frac{E_D}{I_D}$ (negatively)

31. $\frac{V_D}{I_d}$ " " $\frac{V_c}{I_c}$ (Table 5.21)

32. $\frac{E_D}{V_D}$ " " $\frac{E_c}{V_c}$

33. $\frac{E_D}{V_D}$ " " $\frac{V_c}{I_c}$

34. $\frac{E_D}{V_D}$ " " $\frac{E_c}{I_c}$

35. $\frac{E_D}{V_D}$ " " $\frac{V+C}{D+I}$

36. $\frac{E_D}{V_D}$ " " $\frac{In}{D+I}$

37. $\frac{E_D}{I_D}$ " " $\frac{E_c}{V_c}$

38. $\frac{E_D}{I_D}$ " " $\frac{V_c}{I_c}$

39. $\frac{E_D}{I_D}$ " " $\frac{E_c}{I_c}$

40. $\frac{E_D}{I_D}$ " " $\frac{V+C}{D+I}$

41. $\frac{E_D}{I_D}$ " " $\frac{In}{D+I}$

All of these correlations may not apply in all parts of the Patchawarra Formation, as, for example, the lower section where exinite occurs in only a few samples.

The three cycles delineated for the Patchawarra Formation were tested separately. Results for cycle one, the lowest part of the Patchawarra Formation, gave no significant correlations (Tables 5.22 to 5.24). Nor did the second cycle (Tables 5.25 to 5.27).

Third cycle results (above the Malabine seam) are given in Tables 5.28 to 5.30. The relationship found in Table 5.28 are shown on Fig.5.2.

The significant correlations are:

1. E_D correlates with V_c (Table 5.28)
2. E_D " " E_c
3. E_D " " I_c (negatively)
4. E_D " " V+C

5. E_D correlates with In*

6. E_D " " D+I (negatively)

7. I_D " " V_c (negatively)

8. I_D " " I_c

9. I_D " " D+I

10. E_D " " $\frac{V_c}{I_c}$ (Table 5.29)

11. E_D " " $\frac{E_c}{I_c}$

12. E_D " " $\frac{V+C}{D+I}$

13. E_D " " $\frac{In^*}{D+I}$

14. I_D " " $\frac{V_c}{I_c}$ (negatively)

15. I_D " " $\frac{E_c}{I_c}$ (negatively)

16. I_D " " $\frac{V+C}{D+I}$ (negatively)

17. V_D " " $\frac{In^*}{D+I}$

18. V_c " " $\frac{V_D}{I_D}$

19. V_c " " $\frac{E_D}{I_D}$

20. E_c " " $\frac{E_D}{I_D}$

21. I_c " " $\frac{E_D}{I_D}$ (negatively)

22. V+C " " $\frac{E_D}{V_D}$

23. V+C " " $\frac{E_D}{I_D}$

24. In correlates with $\frac{V_{D}}{I_D}$*

25. In " " $\frac{E_{D}}{I_D}$*

26. D+I " " $\frac{E_D}{I_D}$ (negatively)

27. D+I " " $\frac{E_D}{I_D}$ (negatively)

28. $\frac{V_D}{I_D}$ " " $\frac{V_c}{I_c}$ (Table 5.30)

29. $\frac{V_D}{I_D}$ " " $\frac{In}{D+I}$*

30. $\frac{V_D}{I_D}$ " " D+I* (negatively)

31. $\frac{E_D}{V_D}$ " " $\frac{V+C}{D+I}$

32. $\frac{E_D}{V_D}$ " " $\frac{In}{D+I}$

33. $\frac{E_D}{I_D}$ " " $\frac{V_c}{I_c}$

34. $\frac{E_D}{I_D}$ " " $\frac{E_c}{I_c}$

35. $\frac{E_D}{I_D}$ " " $\frac{V+C}{D+I}$

36. $\frac{E_D}{I_D}$ " " $\frac{In}{D+I}$

* correlations not occurring in the Patchawarra Formation as a whole.

Most of the correlations are those found for the Patchawarra Formation as a whole. As no correlations were found for cycles one and two, the Patchawarra Formation sequence is swamped by the cycle three correlations.

Exinite DOM is considered to be a good source for hydrocarbons (Tissot et al., 1974), so its relationships with associated coals are of the most interest. Exinite DOM (E_D) is correlated with many coal macerals and microlithotypes and ratios of these. In essence, the basic positive correlations are:

1. exinite DOM with vitrinite in coal
2. " " " exinite in coal
3. " " " vitrite plus clarite in coal
4. " " " intermediates in coal

Negative correlations are:

exinite DOM with inertinite in coal

exinite DOM with durite plus inertite in coal.

The remaining correlations involve ratios and are more or less obvious from the above correlations.

Summarizing the above, exinite DOM increases with an increase in vitrinite,exinite, vitrite plus clarite, and intermediates in the associated coals. The amount of exinite DOM decreases with an increase of inertinite and durite plus inertite, in the associated coals. With an increase in the vitrite plus clarite content, the ratio of exinite DOM to vitrinite DOM increases.

The other DOM maceral of interest as a source for hydrocarbons is vitrinite, considered by Tissot et al., (1974) as a source of gaseous hydrocarbons. Correlations involving vitrinite DOM are: the ratio of vitrinite DOM to inertinite DOM increases with an increase in the vitrinite, intermediates and ratio of intermediates to durite plus inertite in the associated coals, and decreases with an increase in durite plus inertite.

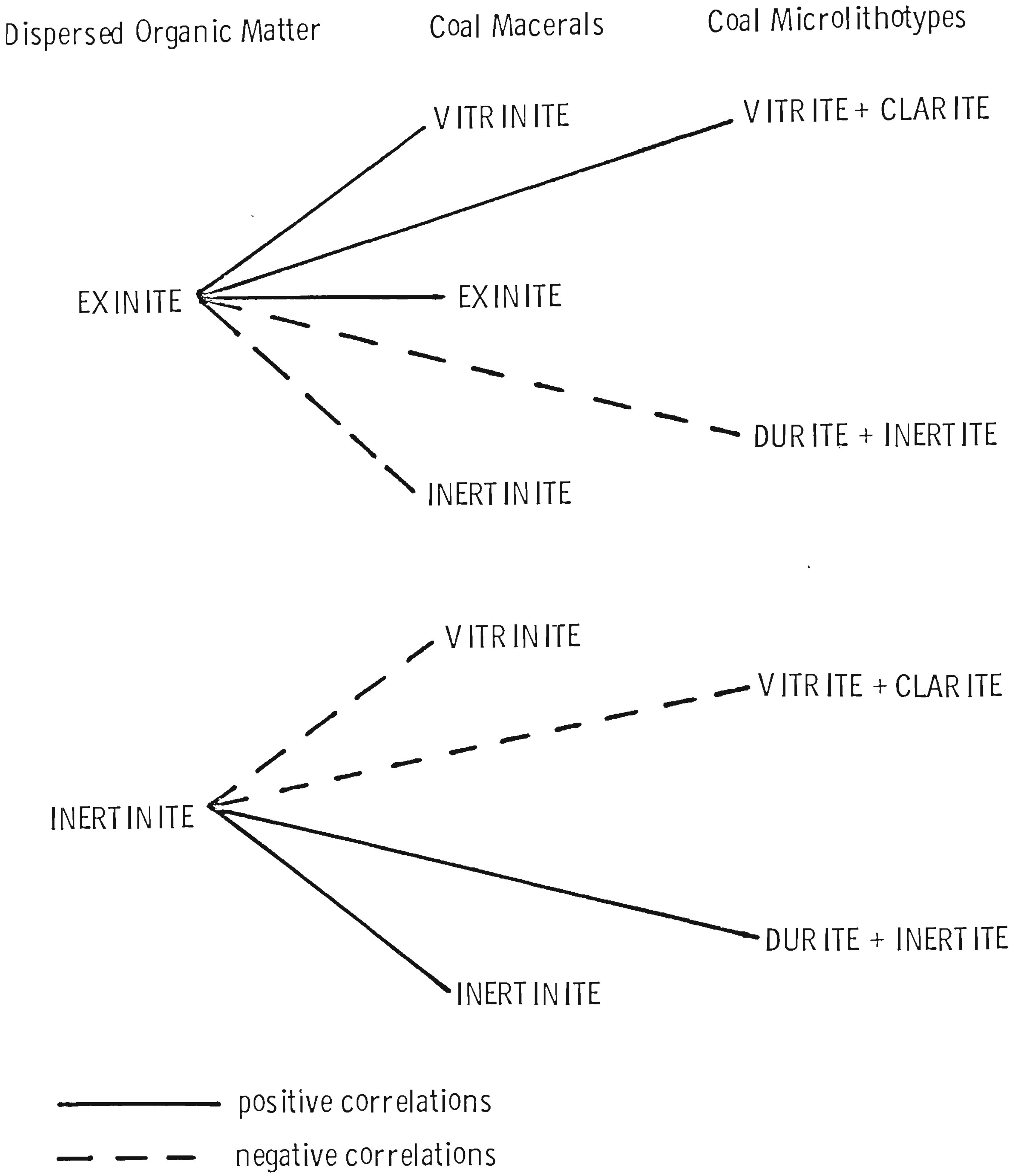


Fig. 5.1 Correlations found for the Patchawarra Formation in Tindilpie 1 well between dispersed organic matter and macerals and microlithotypes in associated coals.

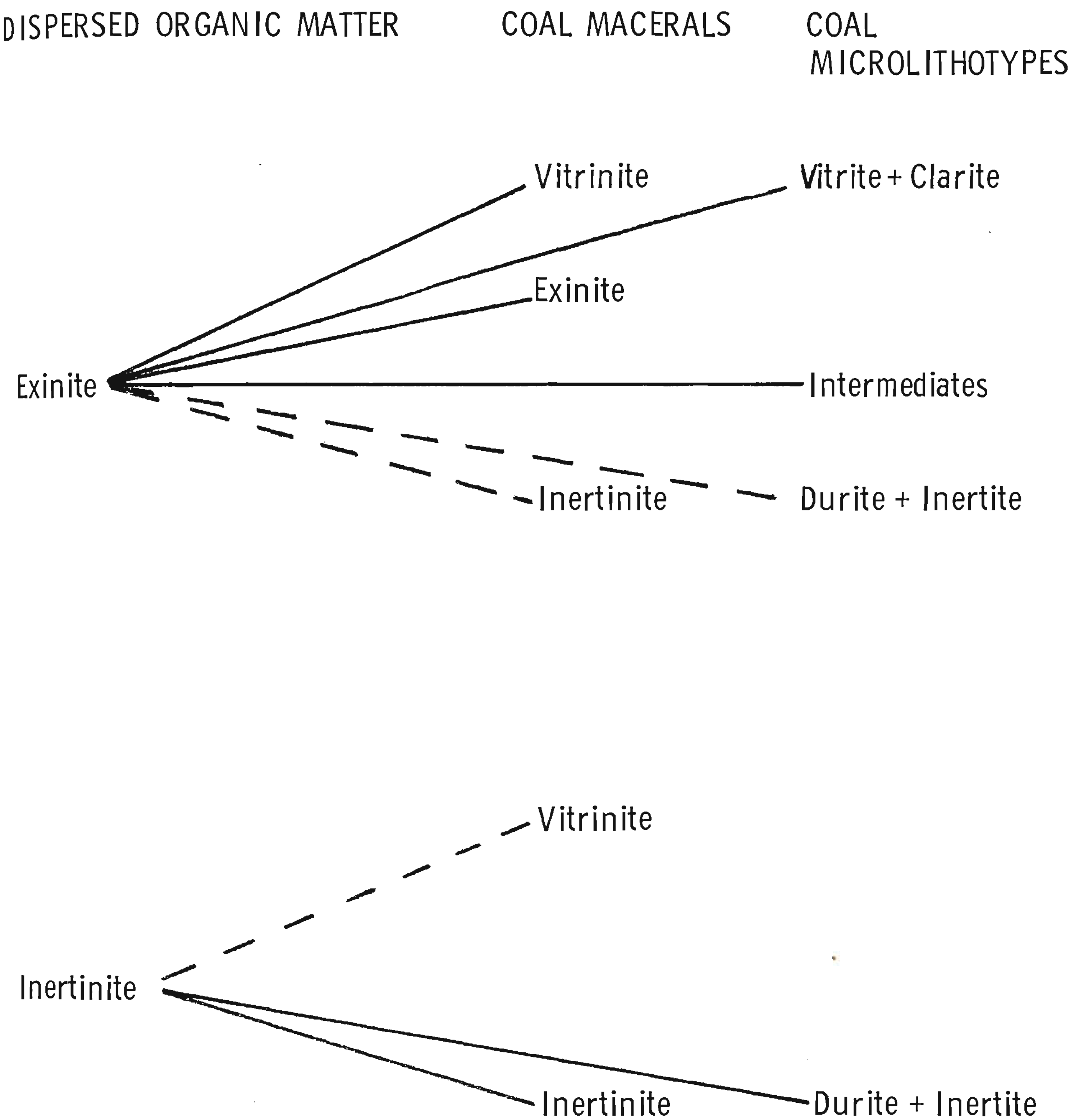


Fig. 5.2 Correlations found for the third cycle of the Patchawarra Formation in Tindilpie 1 well between dispersed organic matter and macerals and microlithotypes of associated coals.

Thus an increase in the vitrinite content of associated coals is correlated with an increase in both vitrinite DOM and exinite DOM, but only the exinite DOM has been correlated with vitrite plus clarite in associated coals. An increase in the ratio of intermediates to durite plus inertite is correlated with an increase in exinite DOM and vitrinite DOM. Both vitrinite DOM and exinite DOM decrease with an increase in durite plus inertite in associated coals.

5 (v) Conclusions

In Mudrangie 1 well no correlations between single macerals were found between DOM and associated coals in the Patchawarra Formation as a whole, nor in the Patchawarra sequence consisting of the Malabine seam and below. (≡ most of Stage 3'). In the sequence above the Malabine seam (≡ upper Stage 3'; Lower Stage 4, Upper Stage 4') vitrinite DOM is significantly correlated with vitrinite in the associated coal.

With the macerals grouped as vitrinite plus exinite, inertodetrinite and remaining inertinites (micrinite, macrinite, semifusinite, fusinite), correlations found for the Patchawarra Formation in Mudrangie 1 are: $\frac{\text{vitrinite DOM + exinite DOM}}{\text{remaining inertinites DOM}}$ with vitrinite plus exinite in coal, and negatively with the ratio of inertodetrinite in coal to vitrinite plus exinite in coal.

For the Patchawarra sequence below the Malabine seam, the only correlation is between remaining inertinites in coal and the ratio of inertodetrinite DOM to vitrinite DOM plus exinite DOM.

In the sequence above the Malabine seam, correlations involve the ratio of inertodetrinite DOM to vitrinite DOM plus exinite DOM with inertodetrinite in coal. The more inertodetrinite in coal, the more inertodetrinite DOM.

As very little exinite is present in the Mudrangie 1 samples, the associations which have emerged are that vitrinite DOM increases as vitrinite increases in the associated coals, and vitrinite DOM decreases with an increase in inertinite in associated coals.

Many correlations were found for the Patchawarra Formation in Tindilpie 1. When the 3 cycles in the Patchawarra Formation were tested sepatately, cycle one ($\equiv$ lower Stage 3') and cycle two ($\equiv$ middle Stage 3') gave no correlations. The bulk of the correlations for the Patchawarra Formation as a whole are derived from the correlations in cycle three ($\equiv$ upper Stage 3', Lower Stage 4, Upper Stage 4').

The essence of the correlations in cycle three is that an increase in the vitrinite content of associated coals gives an increase in vitrinite DOM and exinite DOM. Exinite DOM is also correlated with vitrite plus clarite in associated coals.

Exinite DOM and vitrinite DOM and correlated with the ratio of intermediates to durite plus inertite. A negative association is found between durite plus inertite and both vitrinite DOM and exinite DOM.

The above results support the findings for the Fly Lake - Brolga area, that exinite DOM is associated with the coals higher in vitrite plus clarite. As before, the relationship between vitrinite DOM and intermediates is not so simple, but the statistical findings support rather than disagree with the relationship proposed earlier.

The bulk of the reliable results are from the Patchawarra Formation with too few correlations from the other formations to provide a basis for predictions. Findings on vitrinite DOM and exinite DOM from upper Stage 3', Lower Stage 4 and Upper Stage 4' are the only meaningful ones.

The association of exinite DOM with vitrite plus clarite rich coals has been confirmed for the Patchawarra Formation in two areas of the Patchawarra Trough.

Support for the correlation found above has been sought by studying the coals and DOM in the Permian Pedirka Basin to the west of the Cooper Basin, and the Triassic Simpson Desert and Jurassic-Cretaceous Eromanga Basins which overlie it.

		nobs	tau	sd	z
2	1	33	0.229	0.148	1.549
3	1	33	-0.900	0.124	-7.248
3	2	33	-0.359	0.133	-2.698
4	1	26	0.259	0.142	1.832
4	2	26	0.021	0.153	0.139
4	3	26	-0.255	0.142	-1.790
5	1	26	0.169	0.511	0.330
5	2	26	0.301	0.576	0.522
5	3	26	-0.282	0.514	-0.547
5	4	27	0.119	0.526	0.227
6	1	26	-0.241	0.142	-1.700
6	2	26	-0.075	0.153	-0.488
6	3	26	0.256	0.143	1.790
6	4	27	-0.935	0.140	-6.672
6	5	27	-0.239	0.159	-1.503
7	1	18	0.779	0.176	4.414
7	2	18	0.228	0.187	1.217
7	3	18	-0.781	0.177	-4.420
7	4	11	0.241	0.237	1.017
7	5	11	0.000	1.000	* 55.000
7	6	11	-0.241	0.237	-1.017
8	1	18	0.439	0.175	2.509
8	2	18	0.459	0.186	2.470
8	3	18	-0.500	0.175	-2.854
8	4	11	0.073	0.235	0.312
8	5	11	0.000		*
8	6	11	-0.073	0.235	-0.312
8	7	18	0.332	0.175	1.901
9	1	18	-0.722	0.174	-4.141
9	2	18	-0.378	0.185	-2.038
9	3	18	0.797	0.175	4.564
9	4	11	-0.147	0.235	-0.625
9	5	11	0.000		*
9	6	11	0.147	0.235	0.625
9	7	18	-0.682	0.174	-3.915
9	8	18	-0.656	0.173	-3.790

TABLE 5.1 Correlations between DOM macerals (4,5,6) and coal macerals (1,2,3) and microlithotypes (7,8,9) for the Patchawarra Formation, Mudrangie 1.

1 = V_c	4 = V_D	7 = V+C
2 = E_c	5 = E_D	8 = In
3 = I_c	6 = I_D	9 = D+I

* one or more variables = 0

		nobs	tau	sd	z
2 / 1	1	32	0.045	0.136	0.333
2 / 1	2	32	0.889	0.146	6.097
2 / 1	3	32	-0.176	0.137	-1.285
2 / 1	4	25	-0.004	0.166	-0.022
2 / 1	5	25	0.295	0.198	1.487
2 / 1	6	25	-0.070	0.167	-0.420
2 / 1	7	18	0.089	0.182	0.492
2 / 1	8	18	0.334	0.180	1.850
2 / 1	9	18	-0.231	0.180	-1.283
1 / 3	1	33	0.972	0.123	7.909
1 / 3	2	33	0.264	0.132	2.005
1 / 3	3	33	-0.928	0.124	-7.512
1 / 3	4	26	0.240	0.141	1.701
1 / 3	5	26	0.197	0.160	1.233
1 / 3	6	26	-0.234	0.141	-1.658
1 / 3	7	18	0.744	0.175	4.259
1 / 3	8	18	0.454	0.173	2.617
1 / 3	9	18	-0.734	0.173	-4.245
2 / 3	1	33	0.314	0.136	2.313
2 / 3	2	33	0.938	0.146	6.428
2 / 3	3	33	-0.439	0.136	-3.217
2 / 3	4	26	0.065	0.167	0.389
2 / 3	5	26	0.311	0.204	1.527
2 / 3	6	26	-0.113	0.167	-0.676
2 / 3	7	18	0.282	0.182	1.552
2 / 3	8	18	0.470	0.180	2.606
2 / 3	9	18	-0.421	0.180	-2.340
5 / 4	1	23	0.123	0.472	0.260
5 / 4	2	23	0.307	0.525	0.585
5 / 4	3	23	-0.240	0.473	-0.507
5 / 4	4	24	-0.011	0.487	-0.023
5 / 4	5	24	0.926	0.705	1.313
5 / 4	6	24	-0.132	0.489	-0.270
5 / 4	7	9	0.000	36.000	* 0.000
5 / 4	8	9	0.000	36.000	* 0.000
5 / 4	9	9	0.000	36.000	* 0.000
4 / 6	1	26	0.255	0.141	1.810
4 / 6	2	26	0.025	0.152	0.162
4 / 6	3	26	-0.257	0.142	-1.812
4 / 6	4	27	0.996	0.139	7.152
4 / 6	5	27	0.132	0.158	0.838
4 / 6	6	27	-0.940	0.140	-6.738
4 / 6	7	11	0.241	0.237	1.017
4 / 6	8	11	0.073	0.235	0.312

TABLE 5.2

* One or more variables = 0

4 / 6	9	11	-0.147	0.235	-0.624
5 / 6	1	26	0.177	0.505	0.351
5 / 6	2	26	0.288	0.569	0.506
5 / 6	3	26	-0.279	0.508	-0.551
5 / 6	4	27	0.128	0.519	0.246
5 / 6	5	27	0.993	0.793	1.252
5 / 6	6	27	-0.247	0.521	-0.474
5 / 6	7	11	0.000	55.000	1.000
5 / 6	8	11	0.000	55.000	0.000
5 / 6	9	11	0.000	55.000	0.000
8 / 7	1	18	-0.550	0.174	-3.153
8 / 7	2	18	-0.058	0.185	-0.313
8 / 7	3	18	0.518	0.175	2.967
8 / 7	4	11	-0.220	0.235	-0.937
8 / 7	5	11	0.000		
8 / 7	6	11	0.220	0.235	0.937
8 / 7	7	18	-0.735	0.174	-4.219
8 / 7	8	18	-0.052	0.173	-0.303
8 / 7	9	18	0.399	0.173	2.303
7 / 9	1	18	0.815	0.174	4.672
7 / 9	2	18	0.261	0.185	1.411
7 / 9	3	18	-0.811	0.175	-4.640
7 / 9	4	11	0.183	0.235	0.781
7 / 9	5	11	0.000		
7 / 9	6	11	-0.183	0.235	-0.781
7 / 9	7	18	0.907	0.174	5.207
7 / 9	8	18	0.433	0.173	2.502
7 / 9	9	18	-0.778	0.173	-4.493
8 / 9	1	18	0.656	0.174	3.761
8 / 9	2	18	0.378	0.185	2.038
8 / 9	3	18	-0.718	0.175	-4.108
8 / 9	4	11	0.147	0.235	0.625
8 / 9	5	11	0.000		
8 / 9	6	11	-0.147	0.235	-0.625
8 / 9	7	18	0.550	0.174	3.154
8 / 9	8	18	0.787	0.173	4.549
8 / 9	9	18	-0.869	0.173	-5.021

TABLE 5.2 (continued)

Correlations between ratios of macerals and microlithotypes in DOM and coal to macerals and microlithotypes in DOM and coal, Patchawarra Formation, Mudrangie 1.

		nobs	tau	sd	z
1 / 3	2 / 1	32	0.082	0.129	0.630
2 / 3	2 / 1	32	0.747	0.141	5.315
2 / 3	1 / 3	33	0.347	0.135	2.567
5 / 4	2 / 1	22	0.301	0.487	0.617
5 / 4	1 / 3	23	0.157	0.470	0.334
5 / 4	2 / 3	23	0.295	0.505	0.584
4 / 6	2 / 1	25	0.000	0.151	0.000
4 / 6	1 / 3	26	0.236	0.141	1.677
4 / 6	2 / 3	26	0.068	0.148	0.460
4 / 6	5 / 4	24	0.005	0.166	0.033
5 / 6	2 / 1	25	0.282	0.533	0.529
5 / 6	1 / 3	26	0.196	0.503	0.389
5 / 6	2 / 3	26	0.299	0.549	0.544
5 / 6	5 / 4	24	0.902	0.700	1.290
5 / 6	4 / 6	27	0.141	0.517	0.272
8 / 7	2 / 1	18	0.027	0.177	0.153
8 / 7	1 / 3	18	-0.525	0.173	-3.032
8 / 7	2 / 3	18	-0.081	0.177	-0.460
8 / 7	5 / 4	9	0.000		
8 / 7	4 / 6	11	-0.220	0.235	-0.937
8 / 7	5 / 6	11	0.000		
7 / 9	2 / 1	18	0.109	0.177	0.614
7 / 9	1 / 3	18	0.774	0.173	4.473
7 / 9	2 / 3	18	0.326	0.177	1.842
7 / 9	5 / 4	9	0.000		
7 / 9	4 / 6	11	0.183	0.235	0.781
7 / 9	5 / 6	11	0.000		
7 / 9	8 / 7	18	-0.621	0.173	-3.598
8 / 9	2 / 1	18	0.217	0.177	1.228
8 / 9	1 / 3	18	0.669	0.173	3.866
8 / 9	2 / 3	18	0.434	0.177	2.455
8 / 9	5 / 4	9	0.000		
8 / 9	4 / 6	11	0.147	0.235	0.625
8 / 9	5 / 6	11	0.000		
8 / 9	8 / 7	18	-0.268	0.173	-1.553
8 / 9	7 / 9	18	0.647	0.173	3.750

TABLE 5.3 Correlations of ratios of macerals and microlithotypes for coals and DOM, Patchawarra Formation, Mudrangie 1.

		nobs	tau	sd	z
2	1	19	0.023	0.354	0.064
3	1	19	-0.911	0.170	-5.365
3	2	19	-0.161	0.188	-0.859
4	1	15	0.155	0.195	0.793
4	2	15	-0.084	0.218	-0.386
4	3	15	-0.165	0.196	-0.844
5	1	15	0.230	1.178	0.195
5	2	15	0.277	1.686	0.165
5	3	15	-0.308	1.184	-0.260
5	4	15	0.097	1.195	0.081
6	1	15	-0.087	0.194	-0.446
6	2	15	-0.042	0.217	-0.193
6	3	15	0.135	0.195	0.695
6	4	15	-0.898	0.196	-4.577
6	5	15	-0.309	0.226	-1.365
7	1	9	0.765		
7	2	9	-0.181		
7	3	9	-0.848		
7	4	5	0.738		
7	5	5	0.000	1.000	10.000
7	6	5	-0.738		
8	1	9	0.514		
8	2	9	-0.211		
8	3	9	-0.530		
8	4	5	0.200		
8	5	5	0.000		
8	6	5	-0.200		
8	7	9	0.353		
9	1	9	-0.761		
9	2	9	0.104		
9	3	9	0.841		
9	4	5	-0.600		
9	5	5	0.000		
9	6	5	0.600		
9	7	9	-0.725		
9	8	9	-0.648		

1 = V_C
2 = E_C
3 = I_C

4 = V_D
5 = E_D
6 = I_D

7 = V+C
8 = In
9 = D+I

TABLE 5.4 Correlations of DOM macerals with coal macerals and microlithotypes, Patchawarra Formation, Malabine seam and below, Mudrangie 1.

		nobs	tau	sd	z
2 / 1	1	18	-0.074	0.328	-0.225
2 / 1	2	18	0.964	0.395	2.439
2 / 1	3	18	-0.075	0.332	-0.225
2 / 1	4	14	-0.031	0.571	-0.055
2 / 1	5	14	0.271	1.023	0.265
2 / 1	6	14	-0.109	0.568	-0.193
2 / 1	7	9	-0.273		
2 / 1	8	9	-0.232		
2 / 1	9	9	0.131		
1 / 3	1	19	0.974	0.168	5.811
1 / 3	2	19	0.061	0.186	0.326
1 / 3	3	19	-0.938	0.169	-5.547
1 / 3	4	15	0.135	0.195	0.695
1 / 3	5	15	0.268	0.225	1.189
1 / 3	6	15	-0.106	0.194	-0.546
1 / 3	7	9	0.725		
1 / 3	8	9	0.535		
1 / 3	9	9	-0.778		
2 / 3	1	19	0.045	0.341	0.132
2 / 3	2	19	0.986	0.421	2.341
2 / 3	3	19	-0.182	0.345	-0.527
2 / 3	4	15	-0.084	0.593	-0.142
2 / 3	5	15	0.277	1.109	0.250
2 / 3	6	15	-0.042	0.591	-0.071
2 / 3	7	9	-0.068		
2 / 3	8	9	-0.166		
2 / 3	9	9	0.065		
5 / 4	1	13	0.212	1.107	0.192
5 / 4	2	13	0.290	1.488	0.195
5 / 4	3	13	-0.260	1.107	-0.235
5 / 4	4	13	0.000	1.121	0.000
5 / 4	5	13	0.978	2.035	0.481
5 / 4	6	13	-0.261	1.114	-0.235
5 / 4	7	4	0.000	6.000	0.000
5 / 4	8	4	0.000	6.000	0.000
5 / 4	9	4	0.000	6.000	0.000
4 / 6	1	15	0.144	0.194	0.744
4 / 6	2	15	-0.070	0.217	-0.321
4 / 6	3	15	-0.155	0.195	-0.794
4 / 6	4	15	0.995	0.196	5.075
4 / 6	5	15	0.116	0.226	0.512
4 / 6	6	15	-0.903	0.195	-4.621
4 / 6	7	5	0.728		
4 / 6	8	5	0.200		

TABLE 5.5

4 / 6	9	5	-0.600		
5 / 6	1	15	0.244	1.147	0.213
5 / 6	2	15	0.245	1.641	0.149
5 / 6	3	15	-0.321	1.153	-0.278
5 / 6	4	15	0.114	1.164	0.098
5 / 6	5	15	0.981	2.259	0.434
5 / 6	6	15	-0.322	1.158	-0.278
5 / 6	7	5	0.000	10.000	*1.000
5 / 6	8	5	0.000	10.000	*0.000
5 / 6	9	5	0.000	10.000	*0.000
8 / 7	1	9	-0.423		
8 / 7	2	9	0.243		
8 / 7	3	9	0.435		
8 / 7	4	5	-0.800		
8 / 7	5	5	0.000		
8 / 7	6	5	0.800		
8 / 7	7	9	-0.609		
8 / 7	8	9	0.085		
8 / 7	9	9	0.278		
7 / 9	1	9	0.817		
7 / 9	2	9	-0.174		
7 / 9	3	9	-0.899		
7 / 9	4	5	0.600		
7 / 9	5	5	0.000		
7 / 9	6	5	-0.600		
7 / 9	7	9	0.957		
7 / 9	8	9	0.423		
7 / 9	9	9	-0.778		
8 / 9	1	9	0.648		
8 / 9	2	9	-0.243		
8 / 9	3	9	-0.667		
8 / 9	4	5	0.400		
8 / 9	5	5	0.000		
8 / 9	6	5	-0.400		
8 / 9	7	9	0.493		
8 / 9	8	9	0.873		
8 / 9	9	9	-0.778		

TABLE 5.5 (continued)

Correlations between ratios of macerals and microlithotypes of coals and DOM with macerals and microlithotypes of coals and DOM, Patchawarra Formation, Malabine seam and below, Mudrangie 1.

* one or more variables = 0

		nobs	tau	sd	z
1 / 3	2 / 1	18	-0.033	0.188	-0.173
2 / 3	2 / 1	18	0.918	0.389	2.358
2 / 3	1 / 3	19	0.082	0.341	0.241
5 / 4	2 / 1	12	0.283	1.406	0.201
5 / 4	1 / 3	13	0.260	1.107	0.235
5 / 4	2 / 3	13	0.290	1.488	0.195
4 / 6	2 / 1	14	-0.016	0.225	-0.069
4 / 6	1 / 3	15	0.125	0.194	0.644
4 / 6	2 / 3	15	-0.070	0.217	-0.321
4 / 6	5 / 4	13	0.024	0.241	0.099
5 / 6	2 / 1	14	0.236	1.566	0.151
5 / 6	1 / 3	15	0.282	1.147	0.246
5 / 6	2 / 3	15	0.245	1.641	0.149
5 / 6	5 / 4	13	0.913	1.991	0.459
5 / 6	4 / 6	15	0.133	1.158	0.115
8 / 7	2 / 1	9	0.261		
8 / 7	1 / 3	9	-0.389		
8 / 7	2 / 3	9	0.196		
8 / 7	5 / 4	4	0.000		
8 / 7	4 / 6	5	-0.800		
8 / 7	5 / 6	5	0.000		
7 / 9	2 / 1	9	-0.261		
7 / 9	1 / 3	9	0.778		
7 / 9	2 / 3	9	-0.065		
7 / 9	5 / 4	4	0.000		
7 / 9	4 / 6	5	0.600		
7 / 9	5 / 6	5	0.000		
7 / 9	8 / 7	9	-0.500		
8 / 9	2 / 1	9	-0.261		
8 / 9	1 / 3	9	0.667		
8 / 9	2 / 3	9	-0.196		
8 / 9	5 / 4	4	0.000		
8 / 9	4 / 6	5	0.400		
8 / 9	5 / 6	5	0.000		
8 / 9	8 / 7	9	-0.056		
8 / 9	7 / 9	9	0.556		

TABLE 5.6 Correlations of ratios of macerals and microlithotypes of coals and DOM, Patchawarra Formation, Malabine seam and below, Mudrangie 1.

		nobs	tau	sd	z	
2	1	14	0.195	0.239	0.816	
3	1	14	-0.811	0.202	-4.007	
3	2	14	-0.414	0.214	-1.935	
4	1	11	0.345	0.156	2.210	*
4	2	11	0.062	0.249	0.248	
4	3	11	-0.257	0.235	-1.093	
5	1	11	-0.023	0.496	-0.047	
5	2	11	0.159	0.550	0.290	
5	3	11	-0.095	0.500	-0.190	
5	4	12	0.101	0.524	0.193	
6	1	11	-0.330	0.235	-1.404	
6	2	11	-0.062	0.250	-0.249	
6	3	11	0.241	0.237	1.017	
6	4	12	-0.992	0.222	-4.465	
6	5	12	-0.122	0.246	-0.497	
7	1	9	0.704			
7	2	9	0.031			
7	3	9	-0.667			
7	4	6	-0.200			
7	5	6	0.000			
7	6	6	0.200			
8	1	9	0.141			
8	2	9	0.712			
8	3	9	-0.278			
8	4	6	-0.067			
8	5	6	0.000			
8	6	6	0.067			
8	7	9	-0.056			
9	1	9	-0.535			
9	2	9	-0.464			
9	3	9	0.667			
9	4	6	0.467			
9	5	6	0.000			
9	6	6	-0.467			
9	7	9	-0.444			
9	8	9	-0.500			

1 = V_C
2 = E_C
3 = I_C

4 = V_D
5 = E_D
6 = I_D

7 = V+C
8 = In
9 D+I

TABLE 5.7

Correlations of DOM macerals with coal macerals and microlithotypes, Patchawarra Formation, above Malabine seam, Mudrangie 1.

* significant correlation

		nobs	tau	sd	z
2 / 1	1	14	-0.100	0.202	-0.494
2 / 1	2	14	0.803	0.214	3.755
2 / 1	3	14	-0.100	0.202	-0.494
2 / 1	4	11	-0.110	0.235	-0.468
2 / 1	5	11	0.190	0.258	0.733
2 / 1	6	11	0.093	0.237	0.391
2 / 1	7	9	-0.222		
2 / 1	8	9	0.500		
2 / 1	9	9	-0.222		
1 / 3	1	14	0.950	0.202	4.715
1 / 3	2	14	0.254	0.213	1.193
1 / 3	3	14	-0.862	0.202	-4.277
1 / 3	4	11	0.309	0.234	1.323
1 / 3	5	11	-0.023	0.257	-0.091
1 / 3	6	11	-0.294	0.235	-1.249
1 / 3	7	9	0.667		
1 / 3	8	9	0.167		
1 / 3	9	9	-0.556		
2 / 3	1	14	0.420	0.202	2.083
2 / 3	2	14	0.835	0.213	3.921
2 / 3	3	14	-0.619	0.202	-3.070
2 / 3	4	11	0.127	0.234	0.545
2 / 3	5	11	0.164	0.257	0.640
2 / 3	6	11	-0.110	0.235	-0.469
2 / 3	7	9	0.167		
2 / 3	8	9	0.667		
2 / 3	9	9	-0.500		
5 / 4	1	10	-0.054	0.444	-0.122
5 / 4	2	10	0.157	0.495	0.316
5 / 4	3	10	-0.109	0.444	-0.245
5 / 4	4	11	-0.046	0.477	-0.097
5 / 4	5	11	0.925	0.586	1.580
5 / 4	6	11	0.023	0.481	0.049
5 / 4	7	5	0.000	10.000	+0.000
5 / 4	8	5	0.000	10.000	+0.000
5 / 4	9	5	0.000	10.000	+0.000
4 / 6	1	11	0.345	0.234	1.479
4 / 6	2	11	0.062	0.249	0.248
4 / 6	3	11	-0.257	0.235	-1.093
4 / 6	4	12	1.000	0.221	4.526
4 / 6	5	12	0.101	0.245	0.413
4 / 6	6	12	-0.992	0.222	-4.468
4 / 6	7	6	-0.200		
4 / 6	8	6	-0.067		

TABLE 5.8

+ One or more variables = 0

4 / 6	9	6	0.467		
5 / 6	1	11	0.000	0.477	0.000
5 / 6	2	11	0.131	0.528	0.248
5 / 6	3	11	-0.070	0.481	-0.146
5 / 6	4	12	0.120	0.508	0.236
5 / 6	5	12	0.987	0.647	1.524
5 / 6	6	12	-0.141	0.511	-0.276
5 / 6	7	6	0.000	15.000	0.000
5 / 6	8	6	0.000	15.000	0.000
5 / 6	9	6	0.000	15.000	0.000
8 / 7	1	9	-0.479		
8 / 7	2	9	0.155		
8 / 7	3	9	0.444		
8 / 7	4	6	0.333		
8 / 7	5	6	0.000		
8 / 7	6	6	-0.333		
8 / 7	7	9	-0.778		
8 / 7	8	9	0.278		
8 / 7	9	9	0.222		
7 / 9	1	9	0.761		
7 / 9	2	9	0.217		
7 / 9	3	9	-0.722		
7 / 9	4	6	-0.333		
7 / 9	5	6	0.000		
7 / 9	6	6	0.333		
7 / 9	7	9	0.722		
7 / 9	8	9	0.222		
7 / 9	9	9	-0.722		
8 / 9	1	9	0.479		
8 / 9	2	9	0.588		
8 / 9	3	9	-0.611		
8 / 9	4	6	-0.333		
8 / 9	5	6	0.000		
8 / 9	6	6	0.333		
8 / 9	7	9	0.278		
8 / 9	8	9	0.667		
8 / 9	9	9	-0.833		

TABLE 5.8 (continued)

Correlations between ratios of macerals and microlithotypes of coals and DOM and macerals and microlithotypes in coals and DOM, Patchawarra Formation, above Malabine seam, Mudrangie 1.

		nobs	tau	sd	z
1 / 3	2 / 1	14	-0.044	0.202	-0.219
2 / 3	2 / 1	14	0.486	0.202	2.412
2 / 3	1 / 3	14	0.473	0.201	2.354
5 / 4	2 / 1	10	0.193	0.449	0.429
5 / 4	1 / 3	10	0.000	0.444	0.000
5 / 4	2 / 3	10	0.163	0.444	0.367
4 / 6	2 / 1	11	-0.110	0.235	-0.469
4 / 6	1 / 3	11	0.309	0.234	1.323
4 / 6	2 / 3	11	0.127	0.234	0.545
4 / 6	5 / 4	11	-0.046	0.254	-0.182
5 / 6	2 / 1	11	0.163	0.481	0.340
5 / 6	1 / 3	11	-0.046	0.477	-0.097
5 / 6	2 / 3	11	0.139	0.477	0.291
5 / 6	5 / 4	11	0.882	0.578	1.527
5 / 6	4 / 6	12	0.120	0.508	0.236
8 / 7	2 / 1	9	0.333		
8 / 7	1 / 3	9	-0.444		
8 / 7	2 / 3	9	0.056		
8 / 7	5 / 4	5	0.000		
8 / 7	4 / 6	6	0.333		
8 / 7	5 / 6	6	0.000		
7 / 9	2 / 1	9	-0.056		
7 / 9	1 / 3	9	0.722		
7 / 9	2 / 3	9	0.333		
7 / 9	5 / 4	5	0.000		
7 / 9	4 / 6	6	-0.333		
7 / 9	5 / 6	6	0.000		
7 / 9	8 / 7	9	-0.500		
8 / 9	2 / 1	9	0.278		
8 / 9	1 / 3	9	0.500		
8 / 9	2 / 3	9	0.667		
8 / 9	5 / 4	5	0.000		
8 / 9	4 / 6	6	-0.333		
8 / 9	5 / 6	6	0.000		
8 / 9	8 / 7	9	-0.056		
8 / 9	7 / 9	9	0.556		

TABLE 5.9

Correlations of ratios of macerals and microlithotypes of coals and DOM, Patchawarra Formation, above Malabine seam, Mudrangie 1.

		nobs	tau	sd	z
2	1	33	-0.623	0.125	-4.971
3	1	33	-0.253	0.125	-2.020
3	2	33	-0.150	0.126	-1.197
4	1	26	0.270	0.142	1.901
4	2	26	-0.184	0.143	-1.284
4	3	26	-0.136	0.143	-0.952
5	1	26	-0.122	0.141	-0.862
5	2	26	0.148	0.143	1.040
5	3	26	0.079	0.142	0.553
5	4	27	-0.420	0.139	-3.031
6	1	26	-0.107	0.142	-0.752
6	2	26	0.095	0.144	0.664
6	3	26	-0.063	0.143	-0.443
6	4	27	-0.056	0.140	-0.397
6	5	27	-0.544	0.139	-3.906
7	1	18	0.781	0.177	4.420
7	2	18	-0.466	0.177	-2.631
7	3	18	-0.458	0.177	-2.590
7	4	11	0.147	0.235	0.624
7	5	11	-0.019	0.237	-0.078
7	6	11	0.019	0.239	0.079
8	1	18	0.500	0.175	2.854
8	2	18	-0.321	0.176	-1.828
8	3	18	-0.313	0.175	-1.788
8	4	11	0.018	0.086	0.212
8	5	11	-0.147	0.235	-0.625
8	6	11	0.000	0.238	0.000
8	7	18	0.332	0.175	1.901
9	1	18	-0.797	0.175	-4.564
9	2	18	0.500	0.175	2.855
9	3	18	0.478	0.175	2.737
9	4	11	-0.091	0.085	-1.065
9	5	11	0.220	0.235	0.937
9	6	11	-0.075	0.238	-0.315
9	7	18	-0.682	0.174	-3.915
9	8	18	-0.656	0.173	-3.790

TABLE 5.10 Correlations between DOM macerals (4,5,6) and coal macerals (1,2,3) and microlithotypes (7,8,9) for the Patchawarra Formation, Mudrangie 1.

1 =	$V_C + E_C$	4 =	$V_D + E_D$	7 =	V+C
2 =	Id_C	5 =	Id_D	8 =	In
3 =	RI_C	6 =	RI_D	9 =	D+I

		nobs	tau	sd	z	
2 / 1	1	32	-0.824	0.126	-6.548	
2 / 1	2	32	0.782	0.126	6.196	
2 / 1	3	32	0.119	0.126	0.943	
2 / 1	4	25	-0.267	0.145	-1.850	
2 / 1	5	25	0.158	0.144	1.099	
2 / 1	6	25	0.105	0.145	0.726	
2 / 1	7	18	-0.669	0.174	-3.839	
2 / 1	8	18	-0.472	0.173	-2.729	
2 / 1	9	18	0.712	0.173	4.115	
1 / 3	1	32	0.822	0.126	6.547	
1 / 3	2	32	-0.431	0.126	-3.415	
1 / 3	3	32	-0.490	0.126	-3.885	
1 / 3	4	25	0.229	0.144	1.591	
1 / 3	5	25	-0.071	0.144	-0.491	
1 / 3	6	25	-0.115	0.145	-0.797	
1 / 3	7	18	0.748	0.174	4.295	
1 / 3	8	18	0.485	0.173	2.805	
1 / 3	9	18	-0.778	0.173	-4.493	
2 / 3	1	32	-0.208	0.126	-1.657	
2 / 3	2	32	0.606	0.126	4.798	
2 / 3	3	32	-0.505	0.126	-4.000	
2 / 3	4	25	-0.138	0.144	-0.959	
2 / 3	5	25	0.189	0.144	1.310	
2 / 3	6	25	0.037	0.145	0.258	
2 / 3	7	18	-0.113	0.174	-0.646	
2 / 3	8	18	-0.092	0.173	-0.531	
2 / 3	9	18	0.111	0.173	0.642	
5 / 4	1	24	-0.241	0.147	-1.639	
5 / 4	2	24	0.196	0.148	1.320	
5 / 4	3	24	0.206	0.148	1.393	
5 / 4	4	25	-0.874	0.144	-6.062	
5 / 4	5	25	0.483	0.144	3.367	
5 / 4	6	25	0.000	0.144	0.000	
5 / 4	7	10	-0.270	0.250	-1.078	
5 / 4	8	10	-0.200	0.251	-0.796	
5 / 4	9	10	0.289	0.251	1.150	
4 / 6	1	23	0.359	0.152	2.357	*
4 / 6	2	23	-0.216	0.154	-1.408	
4 / 6	3	23	-0.150	0.153	-0.981	
4 / 6	4	24	0.541	0.149	3.633	
4 / 6	5	24	0.063	0.148	0.423	
4 / 6	6	24	-0.498	0.149	-3.337	
4 / 6	7	8	0.357			
4 / 6	8	8	-0.143			

TABLE 5.11

* significant correlation

4 / 6	9	8	-0.143		
5 / 6	1	23	0.040	0.150	0.264
5 / 6	2	23	0.024	0.152	0.159
5 / 6	3	23	-0.012	0.151	-0.079
5 / 6	4	24	-0.091	0.147	-0.621
5 / 6	5	24	0.684	0.147	4.666
5 / 6	6	24	-0.906	0.148	-6.141
5 / 6	7	8	0.000		
5 / 6	8	8	-0.500		
5 / 6	9	8	0.357		
8 / 7	1	18	-0.518	0.175	-2.967
8 / 7	2	18	0.447	0.175	2.550
8 / 7	3	18	0.279	0.175	1.597
8 / 7	4	11	-0.127	0.085	-1.491
8 / 7	5	11	-0.073	0.235	-0.312
8 / 7	6	11	-0.037	0.238	-0.157
8 / 7	7	18	-0.735	0.174	-4.219
8 / 7	8	18	-0.052	0.173	-0.303
8 / 7	9	18	0.399	0.173	2.303
7 / 9	1	18	0.811	0.175	4.640
7 / 9	2	18	-0.447	0.175	-2.550
7 / 9	3	18	-0.492	0.175	-2.813
7 / 9	4	11	0.127	0.085	1.491
7 / 9	5	11	-0.073	0.235	-0.312
7 / 9	6	11	0.037	0.238	0.157
7 / 9	7	18	0.907	0.174	5.207
7 / 9	8	18	0.433	0.173	2.502
7 / 9	9	18	-0.778	0.173	-4.493
8 / 9	1	18	0.718	0.175	4.108
8 / 9	2	18	-0.513	0.175	-2.931
8 / 9	3	18	-0.425	0.175	-2.433
8 / 9	4	11	0.091	0.085	1.065
8 / 9	5	11	-0.220	0.235	-0.937
8 / 9	6	11	0.075	0.238	0.315
8 / 9	7	18	0.550	0.174	3.154
8 / 9	8	18	0.787	0.173	4.549
8 / 9	9	18	-0.869	0.173	-5.021

TABLE 5.11(continued)

Correlations between ratios of macerals and microlithotypes in DOM and coals to macerals and microlithotypes in coals and DOM, Patchawarra Formation, Mudrangie 1.

		nobs	tau	sd	z	
1 / 3	2 / 1	31	-0.619	0.127	-4.880	
2 / 3	2 / 1	31	0.343	0.127	2.704	
2 / 3	1 / 3	32	-0.020	0.125	-0.162	
5 / 4	2 / 1	23	0.269	0.150	1.797	
5 / 4	1 / 3	23	-0.170	0.150	-1.136	
5 / 4	2 / 3	23	0.150	0.150	1.004	
4 / 6	2 / 1	22	-0.322	0.156	-2.063	*
4 / 6	1 / 3	22	0.364	0.155	2.345	*
4 / 6	2 / 3	22	-0.009	0.156	-0.057	
4 / 6	5 / 4	23	-0.369	0.152	-2.434	
5 / 6	2 / 1	22	0.000	0.154	0.000	
5 / 6	1 / 3	22	0.100	0.154	0.649	
5 / 6	2 / 3	22	0.139	0.154	0.903	
5 / 6	5 / 4	23	0.202	0.150	1.347	
5 / 6	4 / 6	24	0.385	0.148	2.612	
8 / 7	2 / 1	18	0.477	0.173	2.765	
8 / 7	1 / 3	18	-0.516	0.173	-2.992	
8 / 7	2 / 3	18	0.137	0.173	0.795	
8 / 7	5 / 4	10	0.200	0.248	0.805	
8 / 7	4 / 6	8	-0.500			
8 / 7	5 / 6	8	-0.143			
7 / 9	2 / 1	18	-0.673	0.173	-3.901	
7 / 9	1 / 3	18	0.843	0.173	4.886	
7 / 9	2 / 3	18	-0.072	0.173	-0.417	
7 / 9	5 / 4	10	-0.289	0.248	-1.163	
7 / 9	4 / 6	8	0.429			
7 / 9	5 / 6	8	-0.071			
7 / 9	8 / 7	18	-0.621	0.173	-3.598	
8 / 9	2 / 1	18	-0.686	0.173	-3.977	
8 / 9	1 / 3	18	0.699	0.173	4.053	
8 / 9	2 / 3	18	-0.137	0.173	-0.795	
8 / 9	5 / 4	10	-0.289	0.248	-1.163	
8 / 9	4 / 6	8	0.071			
8 / 9	5 / 6	8	-0.429			
8 / 9	8 / 7	18	-0.268	0.173	-1.553	
8 / 9	7 / 9	18	0.647	0.173	3.750	

TABLE 5.12 Correlations between ratios of macerals and microlithotypes in coals and DOM, Patchawarra Formation, Mudrangie 1.

* significant correlation

		nobs	tau	sd	z
2	1	19	-0.485	0.170	-2.847
3	1	19	-0.163	0.171	-0.949
3	2	19	-0.377	0.171	-2.212
4	1	15	0.183	0.194	0.942
4	2	15	0.087	0.195	0.447
4	3	15	-0.309	0.195	-1.589
5	1	15	-0.057	0.193	-0.297
5	2	15	0.019	0.195	0.099
5	3	15	0.067	0.194	0.347
5	4	15	-0.325	0.193	-1.685
6	1	15	-0.137	0.197	-0.695
6	2	15	0.079	0.198	0.398
6	3	15	0.147	0.197	0.745
6	4	15	0.020	0.197	0.099
6	5	15	-0.709	0.196	-3.618
7	1	9	0.848		
7	2	9	-0.235		
7	3	9	-0.706		
7	4	5	0.800		
7	5	5	0.000		
7	6	5	0.000		
8	1	9	0.530		
8	2	9	-0.057		
8	3	9	-0.514		
8	4	5	0.400		
8	5	5	-0.400		
8	6	5	0.400		
8	7	9	0.353		
9	1	9	-0.841		
9	2	9	0.197		
9	3	9	0.648		
9	4	5	-0.600		
9	5	5	0.200		
9	6	5	-0.200		
9	7	9	-0.725		
9	8	9	-0.648		

1 = $V_C + E_C$
2 = Id_C
3 = RI_C

4 = $V_D + E_D$
5 = Id_D
6 = RI_D

7 = V+C
8 = In
9 = D+I

TABLE 5.13 Correlations between DOM macerals (4,5,6) and coal macerals (1,2,3) and microlithotypes (7,8,9) for the Patchawarra Formation, Malabine seam and below, Mudrangie 1.

		nobs	tau	sd	z	
2 / 1	1	18	-0.833	0.175	-4.757	
2 / 1	2	18	0.607	0.174	3.492	
2 / 1	3	18	0.060	0.175	0.343	
2 / 1	4	14	-0.144	0.202	-0.714	
2 / 1	5	14	0.088	0.202	0.438	
2 / 1	6	14	0.124	0.204	0.606	
2 / 1	7	9	-0.783			
2 / 1	8	9	-0.366			
2 / 1	9	9	0.722			
1 / 3	1	18	0.841	0.174	4.827	
1 / 3	2	18	-0.322	0.173	-1.859	
1 / 3	3	18	-0.385	0.175	-2.206	
1 / 3	4	14	0.155	0.202	0.768	
1 / 3	5	14	0.011	0.202	0.054	
1 / 3	6	14	-0.258	0.204	-1.267	
1 / 3	7	9	0.783			
1 / 3	8	9	0.479			
1 / 3	9	9	-0.722			
2 / 3	1	18	-0.186	0.175	-1.065	
2 / 3	2	18	0.700	0.174	4.023	
2 / 3	3	18	-0.620	0.175	-3.539	
2 / 3	4	14	0.167	0.202	0.823	
2 / 3	5	14	0.287	0.202	1.425	
2 / 3	6	14	-0.316	0.205	-1.544	
2 / 3	7	9	0.145			
2 / 3	8	9	0.141			
2 / 3	9	9	-0.167			
5 / 4	1	14	-0.066	0.202	-0.329	
5 / 4	2	14	-0.134	0.203	-0.660	
5 / 4	3	14	0.411	0.202	2.032	*
5 / 4	4	14	-0.818	0.202	-4.057	
5 / 4	5	14	0.451	0.202	2.232	
5 / 4	6	14	-0.191	0.204	-0.936	
5 / 4	7	5	-0.800			
5 / 4	8	5	-0.400			
5 / 4	9	5	0.600			
4 / 6	1	15	0.273	0.197	1.390	
4 / 6	2	15	-0.059	0.198	-0.299	
4 / 6	3	15	-0.186	0.197	-0.944	
4 / 6	4	15	0.429	0.197	2.184	
4 / 6	5	15	0.262	0.196	1.339	
4 / 6	6	15	-0.584	0.199	-2.939	
4 / 6	7	5	0.400			
4 / 6	8	5	0.000			

TABLE 5.14

* significant correlation

4 / 6	9	5	-0.200		
5 / 6	1	15	0.153	0.193	0.793
5 / 6	2	15	-0.116	0.195	-0.596
5 / 6	3	15	-0.106	0.194	-0.546
5 / 6	4	15	-0.077	0.193	-0.396
5 / 6	5	15	0.752	0.193	3.891
5 / 6	6	15	-0.961	0.195	-4.923
5 / 6	7	5	0.000		
5 / 6	8	5	-0.400		
5 / 6	9	5	0.200		
8 / 7	1	9	-0.435		
8 / 7	2	9	0.423		
8 / 7	3	9	0.423		
8 / 7	4	5	-0.600		
8 / 7	5	5	0.200		
8 / 7	6	5	-0.200		
8 / 7	7	9	-0.609		
8 / 7	8	9	0.085		
8 / 7	9	9	0.278		
7 / 9	1	9	0.899		
7 / 9	2	9	-0.197		
7 / 9	3	9	-0.704		
7 / 9	4	5	0.800		
7 / 9	5	5	0.000		
7 / 9	6	5	0.000		
7 / 9	7	9	0.957		
7 / 9	8	9	0.423		
7 / 9	9	9	-0.778		
8 / 9	1	9	0.667		
8 / 9	2	9	-0.197		
8 / 9	3	9	-0.535		
8 / 9	4	5	0.400		
8 / 9	5	5	-0.400		
8 / 9	6	5	0.400		
8 / 9	7	9	0.493		
8 / 9	8	9	0.873		
8 / 9	9	9	-0.778		

TABLE 5.14 (continued)

Correlations between ratios of macerals and microlithotypes in coals and DOM and macerals and microlithotypes in coals and DOM, Patchawarra Formation, Malabine seam and below, Mudrangie 1.

		nobs	tau	sd	z
1 / 3	2 / 1	17	-0.642	0.179	-3.587
2 / 3	2 / 1	17	0.273	0.179	1.525
2 / 3	1 / 3	18	-0.013	0.173	-0.076
5 / 4	2 / 1	13	0.039	0.211	0.183
5 / 4	1 / 3	13	-0.051	0.210	-0.244
5 / 4	2 / 3	13	-0.219	0.211	-1.039
4 / 6	2 / 1	14	-0.226	0.206	-1.098
4 / 6	1 / 3	14	0.268	0.204	1.317
4 / 6	2 / 3	14	0.213	0.204	1.044
4 / 6	5 / 4	14	-0.146	0.205	-0.713
5 / 6	2 / 1	14	-0.155	0.202	-0.768
5 / 6	1 / 3	14	0.253	0.201	1.259
5 / 6	2 / 3	14	0.265	0.202	1.316
5 / 6	5 / 4	14	0.253	0.201	1.259
5 / 6	4 / 6	15	0.515	0.195	2.638
8 / 7	2 / 1	9	0.556		
8 / 7	1 / 3	9	-0.444		
8 / 7	2 / 3	9	0.111		
8 / 7	5 / 4	5	0.600		
8 / 7	4 / 6	5	-0.200		
8 / 7	5 / 6	5	0.200		
7 / 9	2 / 1	9	-0.833		
7 / 9	1 / 3	9	0.833		
7 / 9	2 / 3	9	0.167		
7 / 9	5 / 4	5	-0.800		
7 / 9	4 / 6	5	0.400		
7 / 9	5 / 6	5	0.000		
7 / 9	8 / 7	9	-0.500		
8 / 9	2 / 1	9	-0.500		
8 / 9	1 / 3	9	0.611		
8 / 9	2 / 3	9	0.167		
8 / 9	5 / 4	5	-0.400		
8 / 9	4 / 6	5	0.000		
8 / 9	5 / 6	5	-0.400		
8 / 9	8 / 7	9	-0.056		
8 / 9	7 / 9	9	0.556		

TABLE 5.15 Correlations of ratios of macerals and microlithotypes in coals and DOM, Patchawarra Formation, Malabine seam and below, Mudrangie 1.

		nobs	tau	sd	z
2	1	14	-0.655	0.206	-3.184
3	1	14	-0.425	0.203	-2.087
3	2	14	0.057	0.206	0.276
4	1	11	0.241	0.237	1.017
4	2	11	-0.434	0.240	-1.811
4	3	11	0.000	0.237	0.000
5	1	11	-0.220	0.235	-0.937
5	2	11	0.262	0.238	1.100
5	3	11	0.147	0.235	0.625
5	4	12	-0.626	0.222	-2.818
6	1	11	0.132	0.242	0.547
6	2	11	0.096	0.245	0.393
6	3	11	-0.359	0.242	-1.484
6	4	12	-0.079	0.229	-0.343
6	5	12	-0.313	0.228	-1.370
7	1	9	0.667		
7	2	9	-0.457		
7	3	9	-0.028		
7	4	6	-0.200		
7	5	6	0.333		
7	6	6	0.149		
8	1	9	0.278		
8	2	9	-0.057		
8	3	9	-0.085		
8	4	6	-0.067		
8	5	6	-0.067		
8	6	6	0.000		
8	7	9	-0.056		
9	1	9	-0.667		
9	2	9	0.286		
9	3	9	0.366		
9	4	6	0.467		
9	5	6	-0.067		
9	6	6	-0.149		
9	7	9	-0.444		
9	8	9	-0.500		

1 = $V_C + E_C$
2 = Id_C
3 = RI_C

4 = $V_D + E_D$
5 = Id_D
6 = RI_D

7 = V+C
8 = In
9 = D+I

TABLE 5.16 Correlations between DOM macerals (4,5,6) and coal macerals (1,2,3) and microlithotypes (7,8,9), Patchawarra Formation above Malabine seam, Mudrangie 1.

		nobs	tau	sd	z	
2 / 1	1	14	-0.773	0.202	-3.838	
2 / 1	2	14	0.888	0.204	4.351	
2 / 1	3	14	0.189	0.202	0.933	
2 / 1	4	11	-0.330	0.235	-1.406	
2 / 1	5	11	0.164	0.236	0.694	
2 / 1	6	11	0.000	0.238	0.000	
2 / 1	7	9	-0.500			
2 / 1	8	9	-0.111			
2 / 1	9	9	0.389			
1 / 3	1	14	0.796	0.202	3.948	
1 / 3	2	14	-0.438	0.204	-2.148	
1 / 3	3	14	-0.633	0.202	-3.130	
1 / 3	4	11	0.110	0.235	0.469	
1 / 3	5	11	-0.236	0.236	-1.003	
1 / 3	6	11	0.299	0.238	1.260	
1 / 3	7	9	0.444			
1 / 3	8	9	0.389			
1 / 3	9	9	-0.778			
2 / 3	1	14	-0.088	0.202	-0.439	
2 / 3	2	14	0.461	0.204	2.258	
2 / 3	3	14	-0.500	0.202	-2.471	
2 / 3	4	11	-0.404	0.235	-1.718	
2 / 3	5	11	0.164	0.236	0.694	
2 / 3	6	11	0.337	0.238	1.417	
2 / 3	7	9	-0.222			
2 / 3	8	9	0.056			
2 / 3	9	9	-0.111			
5 / 4	1	10	-0.378	0.209	-1.807	
5 / 4	2	10	0.644	0.254	2.535	*
5 / 4	3	10	0.000	0.250	0.000	
5 / 4	4	11	-0.954	0.235	-4.061	
5 / 4	5	11	0.600	0.236	2.546	
5 / 4	6	11	0.204	0.236	0.862	
5 / 4	7	5	0.000			
5 / 4	8	5	-0.200			
5 / 4	9	5	-0.200			
4 / 6	1	8	0.571			
4 / 6	2	8	-0.764			
4 / 6	3	8	-0.214			
4 / 6	4	9	0.889			
4 / 6	5	9	-0.556			
4 / 6	6	9	-0.141			
4 / 6	7	3	0.333			
4 / 6	8	3	-0.333			

TABLE 5.17

* significant correlation

4 / 6	9	3	0.333
5 / 6	1	8	-0.429
5 / 6	2	8	0.255
5 / 6	3	8	0.357
5 / 6	4	9	-0.111
5 / 6	5	9	0.444
5 / 6	6	9	-0.873
5 / 6	7	3	-0.333
5 / 6	8	3	-1.000
5 / 6	9	3	1.000
8 / 7	1	9	-0.444
8 / 7	2	9	0.457
8 / 7	3	9	-0.141
8 / 7	4	6	0.333
8 / 7	5	6	-0.467
8 / 7	6	6	0.000
8 / 7	7	9	-0.778
8 / 7	8	9	0.278
8 / 7	9	9	0.222
7 / 9	1	9	0.722
7 / 9	2	9	-0.400
7 / 9	3	9	-0.197
7 / 9	4	6	-0.333
7 / 9	5	6	0.200
7 / 9	6	6	0.000
7 / 9	7	9	0.722
7 / 9	8	9	0.222
7 / 9	9	9	-0.722
8 / 9	1	9	0.611
8 / 9	2	9	-0.286
8 / 9	3	9	-0.310
8 / 9	4	6	-0.333
8 / 9	5	6	0.200
8 / 9	6	6	0.000
8 / 9	7	9	0.278
8 / 9	8	9	0.667
8 / 9	9	9	-0.833

TABLE 5.17 (continued)

Correlation of ratios of maceral and microlithotypes in coals and DOM and macerals and microlithotypes in coals and DOM, Patchawarra Formation above Malabine seam, Mudrangie 1.

		nobs	tau	sd	z	
1 / 3	2 / 1	14	-0.560	0.201	-2.792	
2 / 3	2 / 1	14	0.319	0.201	1.588	
2 / 3	1 / 3	14	0.121	0.201	0.602	
5 / 4	2 / 1	10	0.511	0.248	2.057	*
5 / 4	1 / 3	10	-0.200	0.248	-0.805	
5 / 4	2 / 3	10	0.511	0.248	2.057	*
4 / 6	2 / 1	8	-0.643			
4 / 6	1 / 3	8	0.429			
4 / 6	2 / 3	8	-0.429			
4 / 6	5 / 4	9	-0.889			
5 / 6	2 / 1	8	0.357			
5 / 6	1 / 3	8	-0.571			
5 / 6	2 / 3	8	0.000			
5 / 6	5 / 4	9	0.111			
5 / 6	4 / 6	9	0.000			
8 / 7	2 / 1	9	0.389			
8 / 7	1 / 3	9	-0.222			
8 / 7	2 / 3	9	0.222			
8 / 7	5 / 4	5	-0.200			
8 / 7	4 / 6	3	-1.000			
8 / 7	5 / 6	3	-0.333			
7 / 9	2 / 1	9	-0.444			
7 / 9	1 / 3	9	0.722			
7 / 9	2 / 3	9	-0.056			
7 / 9	5 / 4	5	0.000			
7 / 9	4 / 6	3	0.333			
7 / 9	5 / 6	3	-0.333			
7 / 9	8 / 7	9	-0.500			
8 / 9	2 / 1	9	-0.444			
8 / 9	1 / 3	9	0.722			
8 / 9	2 / 3	9	0.056			
8 / 9	5 / 4	5	0.000			
8 / 9	4 / 6	3	-0.333			
8 / 9	5 / 6	3	-1.000			
8 / 9	8 / 7	9	-0.056			
8 / 9	7 / 9	9	0.556			

TABLE 5.18 Correlations of ratios of macerals and microlithotypes in coals and DOM, Patchawarra Formation above Malabine seam, Mudrangie 1.

* significant correlation

		nobs	tau	sd	z	
2	1	36	0.375	0.130	2.886	
3	1	36	-0.913	0.119	-7.701	
3	2	36	-0.481	0.124	-3.888	
4	1	36	0.085	0.119	0.710	
4	2	36	-0.116	0.125	-0.931	
4	3	36	-0.066	0.119	-0.559	
5	1	36	0.579	0.167	3.473	*
5	2	36	0.543	0.175	3.102	*
5	3	36	-0.618	0.166	-3.728	*
5	4	36	-0.185	0.167	-1.109	
6	1	36	-0.513	0.119	-4.315	*
6	2	36	-0.193	0.124	-1.556	
6	3	36	0.492	0.118	4.161	*
6	4	36	-0.503	0.119	-4.234	
6	5	36	-0.376	0.127	-2.955	
7	1	29	0.772	0.134	5.745	
7	2	29	0.524	0.140	3.743	
7	3	29	-0.786	0.133	-5.902	
7	4	29	0.035	0.134	0.263	
7	5	29	0.516	0.143	3.597	*
7	6	29	-0.444	0.133	-3.329	*
8	1	29	0.303	0.136	2.223	
8	2	29	0.167	0.142	1.177	
8	3	29	-0.266	0.135	-1.974	
8	4	29	0.087	0.136	0.640	
8	5	29	0.236	0.145	1.626	
8	6	29	-0.264	0.135	-1.956	
8	7	29	0.106	0.135	0.789	
9	1	29	-0.714	0.135	-5.294	
9	2	29	-0.412	0.140	-2.933	
9	3	29	0.663	0.134	4.964	
9	4	29	-0.073	0.134	-0.546	
9	5	29	-0.448	0.144	-3.111	*
9	6	29	0.453	0.134	3.386	*
9	7	29	-0.565	0.133	-4.230	
9	8	29	-0.567	0.135	-4.201	

TABLE 5.19 Correlation of DOM macerals (4,5,6) with coal macerals (1,2,3) and microlithotypes (7,8,9) Patchawarra Formation, Tindilpie 1.

1 = V_C
2 = E_C
3 = I_C

4 = V_D
5 = E_D
6 = I_D

7 = V+C
8 = In
9 = D+I

* significant correlation

		nobs	tau	sd	z	
2 / 1	1	36	0.135	0.119	1.134	
2 / 1	2	36	0.835	0.124	6.725	
2 / 1	3	36	-0.236	0.118	-1.992	
2 / 1	4	36	-0.169	0.119	-1.421	
2 / 1	5	36	0.404	0.127	3.176	*
2 / 1	6	36	-0.055	0.119	-0.464	
2 / 1	7	29	0.315	0.133	2.368	
2 / 1	8	29	0.089	0.134	0.659	
2 / 1	9	29	-0.243	0.133	-1.824	
1 / 3	1	36	0.960	0.118	8.121	
1 / 3	2	36	0.426	0.123	3.456	
1 / 3	3	36	-0.954	0.117	-8.126	
1 / 3	4	36	0.077	0.118	0.655	
1 / 3	5	36	0.584	0.126	4.621	*
1 / 3	6	36	-0.501	0.118	-4.256	*
1 / 3	7	29	0.782	0.133	5.899	
1 / 3	8	29	0.280	0.134	2.090	
1 / 3	9	29	-0.695	0.133	-5.227	
2 / 3	1	36	0.494	0.119	4.153	
2 / 3	2	36	0.915	0.124	7.378	
2 / 3	3	36	-0.592	0.118	-5.008	
2 / 3	4	36	-0.044	0.119	-0.369	
2 / 3	5	36	0.544	0.127	4.274	*
2 / 3	6	36	-0.267	0.118	-2.253	*
2 / 3	7	29	0.599	0.133	4.510	
2 / 3	8	29	0.200	0.134	1.488	
2 / 3	9	29	-0.489	0.133	-3.667	
5 / 4	1	36	0.483	0.163	2.966	*
5 / 4	2	36	0.497	0.171	2.906	*
5 / 4	3	36	-0.533	0.162	-3.293	*
5 / 4	4	36	-0.289	0.163	-1.773	
5 / 4	5	36	0.889	0.179	4.967	
5 / 4	6	36	-0.267	0.162	-1.647	
5 / 4	7	29	0.511	0.190	2.684	*
5 / 4	8	29	0.210	0.193	1.093	
5 / 4	9	29	-0.397	0.191	-2.078	*
4 / 6	1	36	0.257	0.118	2.171	*
4 / 6	2	36	0.000	0.123	0.000	
4 / 6	3	36	-0.234	0.118	-1.991	*
4 / 6	4	36	0.806	0.118	6.812	
4 / 6	5	36	0.024	0.126	0.190	
4 / 6	6	36	-0.702	0.118	-5.961	
4 / 6	7	29	0.204	0.133	1.541	
4 / 6	8	29	0.184	0.134	1.375	

TABLE 5.20

4 / 6	9	29	-0.248	0.133	-1.862	
5 / 6	1	36	0.579	0.163	3.557	*
5 / 6	2	36	0.532	0.171	3.113	*
5 / 6	3	36	-0.614	0.162	-3.793	*
5 / 6	4	36	-0.163	0.163	-1.000	
5 / 6	5	36	0.986	0.179	5.513	
5 / 6	6	36	-0.392	0.162	-2.419	
5 / 6	7	29	0.505	0.190	2.653	*
5 / 6	8	29	0.246	0.193	1.275	
5 / 6	9	29	-0.455	0.191	-2.381	*
8 / 7	1	29	-0.405	0.134	-3.031	
8 / 7	2	29	-0.338	0.139	-2.429	
8 / 7	3	29	0.433	0.132	3.268	
8 / 7	4	29	-0.033	0.133	-0.244	
8 / 7	5	29	-0.272	0.143	-1.909	
8 / 7	6	29	0.249	0.133	1.880	
8 / 7	7	29	-0.629	0.132	-4.752	
8 / 7	8	29	0.279	0.134	2.089	
8 / 7	9	29	0.180	0.133	1.353	
7 / 9	1	29	0.870	0.134	6.512	
7 / 9	2	29	0.512	0.139	3.682	
7 / 9	3	29	-0.847	0.132	-6.404	
7 / 9	4	29	0.085	0.133	0.639	
7 / 9	5	29	0.486	0.143	3.411	*
7 / 9	6	29	-0.481	0.133	-3.627	*
7 / 9	7	29	0.844	0.132	6.384	
7 / 9	8	29	0.271	0.134	2.032	
7 / 9	9	29	-0.725	0.133	-5.469	
8 / 9	1	29	0.524	0.134	3.916	
8 / 9	2	29	0.320	0.139	2.295	
8 / 9	3	29	-0.481	0.133	-3.626	
8 / 9	4	29	0.075	0.133	0.564	
8 / 9	5	29	0.383	0.143	2.681	*
8 / 9	6	29	-0.392	0.133	-2.951	*
8 / 9	7	29	0.353	0.132	2.667	
8 / 9	8	29	0.771	0.134	5.760	
8 / 9	9	29	-0.807	0.133	-6.072	

TABLE 5.20 (continued)

Correlations of ratios of macerals and microlithotypes of coals and DOM with macerals and microlithotypes of coals and DOM, Patchawarra Formation, Tindilpie 1.

* significant correlation

		nobs	tau	sd	z	
1 / 3	2 / 1	36	0.185	0.118	1.570	
2 / 3	2 / 1	36	0.643	0.119	5.424	
2 / 3	1 / 3	36	0.540	0.118	4.583	
5 / 4	2 / 1	36	0.391	0.162	2.409	*
5 / 4	1 / 3	36	0.496	0.161	3.076	*
5 / 4	2 / 3	36	0.489	0.162	3.011	*
4 / 6	2 / 1	36	-0.114	0.118	-0.969	
4 / 6	1 / 3	36	0.244	0.117	2.085	*
4 / 6	2 / 3	36	0.087	0.118	0.737	
4 / 6	5 / 4	36	-0.081	0.125	-0.643	
5 / 6	2 / 1	36	0.399	0.162	2.454	*
5 / 6	1 / 3	36	0.584	0.161	3.621	*
5 / 6	2 / 3	36	0.533	0.162	3.284	*
5 / 6	5 / 4	36	0.857	0.177	4.833	
5 / 6	4 / 6	36	0.044	0.161	0.272	
8 / 7	2 / 1	29	-0.203	0.132	-1.540	
8 / 7	1 / 3	29	-0.421	0.132	-3.191	
8 / 7	2 / 3	29	-0.362	0.132	-2.742	
8 / 7	5 / 4	29	-0.275	0.141	-1.947	
8 / 7	4 / 6	29	-0.116	0.132	-0.883	
8 / 7	5 / 6	29	-0.264	0.141	-1.866	
7 / 9	2 / 1	29	0.300	0.132	2.272	
7 / 9	1 / 3	29	0.878	0.132	6.663	
7 / 9	2 / 3	29	0.617	0.132	4.675	
7 / 9	5 / 4	29	0.441	0.141	3.122	*
7 / 9	4 / 6	29	0.252	0.132	1.915	
7 / 9	5 / 6	29	0.487	0.141	3.447	*
7 / 9	8 / 7	29	-0.461	0.131	-3.508	
8 / 9	2 / 1	29	0.201	0.132	1.521	
8 / 9	1 / 3	29	0.493	0.132	3.736	
8 / 9	2 / 3	29	0.360	0.132	2.724	
8 / 9	5 / 4	29	0.356	0.142	2.515	*
8 / 9	4 / 6	29	0.208	0.132	1.577	
8 / 9	5 / 6	29	0.391	0.142	2.758	*
8 / 9	8 / 7	29	0.027	0.132	0.206	
8 / 9	7 / 9	29	0.514	0.132	3.903	

TABLE 5.21 Correlations of ratios of macerals and microlithotypes of coals and DOM, Patchawarra Formation, Tindilpie 1.

* significant correlation

		nobs	tau	sd	z
2	1	6	-0.358		
3	1	6	-1.000		
3	2	6	0.358		
4	1	6	0.600		
4	2	6	-0.358		
4	3	6	-0.600		
5	1	6	0.000	15.000	0.000
5	2	6	0.000	15.000	2.000
5	3	6	0.000	15.000	0.000
5	4	6	0.000	15.000	0.000
6	1	6	-0.600		
6	2	6	0.358		
6	3	6	0.600		
6	4	6	-1.000		
6	5	6	0.000		
7	1	4	1.000		
7	2	4	-0.548		
7	3	4	-1.000		
7	4	4	0.667		
7	5	4	0.000		
7	6	4	-0.667		
8	1	4	0.183		
8	2	4	0.400		
8	3	4	-0.183		
8	4	4	0.548		
8	5	4	0.000	1.000	6.000
8	6	4	-0.548		
8	7	4	0.183		
9	1	4	-0.667		
9	2	4	0.183		
9	3	4	0.667		
9	4	4	-1.000		
9	5	4	0.000		
9	6	4	1.000		
9	7	4	-0.667		
9	8	4	-0.548		

1 = V_C
2 = E_C
3 = I_C

4 = V_D
5 = E_D
6 = I_D

7 = V+C
8 = In
9 = D+I

TABLE 5.22

Correlations between DOM macerals (4,5,6) and coal macerals (1,2,3) and microlithotypes (7,8,9) in the Patchawarra Formation, first cycle, Tindilpie 1.

		nobs	tau	sd	z
2 / 1	1	6	-0.414		
2 / 1	2	6	0.964		
2 / 1	3	6	0.414		
2 / 1	4	6	-0.414		
2 / 1	5	6	0.000	1.000	15.000
2 / 1	6	6	0.414		
2 / 1	7	4	-0.667		
2 / 1	8	4	0.183		
2 / 1	9	4	0.333		
1 / 3	1	6	1.000		
1 / 3	2	6	-0.358		
1 / 3	3	6	-1.000		
1 / 3	4	6	0.600		
1 / 3	5	6	0.000		
1 / 3	6	6	-0.600		
1 / 3	7	4	1.000		
1 / 3	8	4	0.183		
1 / 3	9	4	-0.667		
2 / 3	1	6	-0.276		
2 / 3	2	6	0.964		
2 / 3	3	6	0.276		
2 / 3	4	6	-0.276		
2 / 3	5	6	0.000	1.000	15.000
2 / 3	6	6	0.276		
2 / 3	7	4	-0.333		
2 / 3	8	4	0.548		
2 / 3	9	4	0.000		
5 / 4	1	6	0.000	15.000	0.000
5 / 4	2	6	0.000	15.000	2.000
5 / 4	3	6	0.000	15.000	0.000
5 / 4	4	6	0.000	15.000	0.000
5 / 4	5	6	0.000	15.000	15.000
5 / 4	6	6	0.000	15.000	0.000
5 / 4	7	4	0.000	6.000	0.000
5 / 4	8	4	0.000	6.000	1.000
5 / 4	9	4	0.000	6.000	0.000
4 / 6	1	6	0.600		
4 / 6	2	6	-0.358		
4 / 6	3	6	-0.600		
4 / 6	4	6	1.000		
4 / 6	5	6	0.000		
4 / 6	6	6	-1.000		
4 / 6	7	4	0.667		
4 / 6	8	4	0.548		

TABLE 5.23

4 / 6	9	4	-1.000		
5 / 6	1	6	0.000	15.000	0.000
5 / 6	2	6	0.000	15.000	2.000
5 / 6	3	6	0.000	15.000	0.000
5 / 6	4	6	0.000	15.000	0.000
5 / 6	5	6	0.000	15.000	15.000
5 / 6	6	6	0.000	15.000	0.000
5 / 6	7	4	0.000	6.000	0.000
5 / 6	8	4	0.000	6.000	1.000
5 / 6	9	4	0.000	6.000	0.000
8 / 7	1	4	-1.000		
8 / 7	2	4	0.548		
8 / 7	3	4	1.000		
8 / 7	4	4	-0.667		
8 / 7	5	4	0.000		
8 / 7	6	4	0.667		
8 / 7	7	4	-1.000		
8 / 7	8	4	-0.183		
8 / 7	9	4	0.667		
7 / 9	1	4	1.000		
7 / 9	2	4	-0.548		
7 / 9	3	4	-1.000		
7 / 9	4	4	0.667		
7 / 9	5	4	0.000		
7 / 9	6	4	-0.667		
7 / 9	7	4	1.000		
7 / 9	8	4	0.183		
7 / 9	9	4	-0.667		
8 / 9	1	4	0.667		
8 / 9	2	4	-0.183		
8 / 9	3	4	-0.667		
8 / 9	4	4	1.000		
8 / 9	5	4	0.000		
8 / 9	6	4	-1.000		
8 / 9	7	4	0.667		
8 / 9	8	4	0.548		
8 / 9	9	4	-1.000		

TABLE 5.23 (continued)

Correlations of the ratios of macerals and microlithotypes of coals and DOM with macerals and microlithotypes of coals and DOM, Patchawarra Formation, first cycle, Tindilpie 1.

		nobs	tau	sd	z
1 / 3	2 / 1	6	-0.414		
2 / 3	2 / 1	6	0.857		
2 / 3	1 / 3	6	-0.276		
5 / 4	2 / 1	6	0.000	15.000	1.000
5 / 4	1 / 3	6	0.000	15.000	0.000
5 / 4	2 / 3	6	0.000	15.000	1.000
4 / 6	2 / 1	6	-0.414		
4 / 6	1 / 3	6	0.600		
4 / 6	2 / 3	6	-0.276		
4 / 6	5 / 4	6	0.000		
5 / 6	2 / 1	6	0.000	15.000	1.000
5 / 6	1 / 3	6	0.000	15.000	0.000
5 / 6	2 / 3	6	0.000	15.000	1.000
5 / 6	5 / 4	6	0.000	15.000	15.000
5 / 6	4 / 6	6	0.000	15.000	0.000
8 / 7	2 / 1	4	0.667		
8 / 7	1 / 3	4	-1.000		
8 / 7	2 / 3	4	0.333		
8 / 7	5 / 4	4	0.000		
8 / 7	4 / 6	4	-0.667		
8 / 7	5 / 6	4	0.000		
7 / 9	2 / 1	4	-0.667		
7 / 9	1 / 3	4	1.000		
7 / 9	2 / 3	4	-0.333		
7 / 9	5 / 4	4	0.000		
7 / 9	4 / 6	4	0.667		
7 / 9	5 / 6	4	0.000		
7 / 9	8 / 7	4	-1.000		
8 / 9	2 / 1	4	-0.333		
8 / 9	1 / 3	4	0.667		
8 / 9	2 / 3	4	0.000		
8 / 9	5 / 4	4	0.000		
8 / 9	4 / 6	4	1.000		
8 / 9	5 / 6	4	0.000		
8 / 9	8 / 7	4	-0.667		
8 / 9	7 / 9	4	0.667		

TABLE 5.24 Correlations of ratios of macerals and microlithotypes of coals and DOM, Patchawarra Formation, first cycle, Tindilpie 1.

		nobs	tau	sd	z
2	1	11	0.114	0.419	0.273
3	1	11	-0.991	0.238	-4.160
3	2	11	-0.136	0.260	-0.524
4	1	11	0.299	0.238	1.256
4	2	11	0.091	0.260	0.349
4	3	11	-0.278	0.237	-1.174
5	1	11	-0.261	1.883	-0.138
5	2	11	-0.053	2.272	-0.023
5	3	11	0.258	1.866	0.138
5	4	11	-0.344	1.866	-0.185
6	1	11	-0.411	0.238	-1.727
6	2	11	0.091	0.260	0.349
6	3	11	0.389	0.237	1.643
6	4	11	-0.815	0.237	-3.443
6	5	11	0.258	0.270	0.957
7	1	10	0.796	0.252	3.156
7	2	10	0.507	0.274	1.850
7	3	10	-0.809	0.250	-3.233
7	4	10	0.405	0.250	1.616
7	5	10	-0.248	0.285	-0.870
7	6	10	-0.405	0.250	-1.616
8	1	10	-0.046	0.254	-0.181
8	2	10	-0.598	0.276	-2.165
8	3	10	0.068	0.252	0.270
8	4	10	-0.114	0.252	-0.450
8	5	10	0.151	0.286	0.527
8	6	10	0.114	0.252	0.450
8	7	10	-0.270	0.251	-1.076
9	1	10	-0.488	0.257	-1.897
9	2	10	0.231	0.280	0.824
9	3	10	0.460	0.256	1.799
9	4	10	-0.092	0.256	-0.360
9	5	10	0.203	0.290	0.701
9	6	10	0.092	0.256	0.360
9	7	10	-0.250	0.254	-0.985
9	8	10	-0.506	0.256	-1.979

TABLE 5.25 Correlations of DOM macerals (4,5,6) with coal macerals (1,2,3) and microlithotypes (7,8,9), Patchawarra Formation, second cycle, Tindilpie 1.

1 = V_C	4 = V_D	7 = V+C
2 = E_C	5 = E_D	8 = In
3 = I_C	6 = I_D	9 = D+I

		nobs	tau	sd	z
2 / 1	1	11	-0.318	0.238	-1.334
2 / 1	2	11	0.726	0.260	2.792
2 / 1	3	11	0.296	0.237	1.252
2 / 1	4	11	-0.019	0.237	-0.078
2 / 1	5	11	0.086	0.270	0.319
2 / 1	6	11	0.204	0.237	0.861
2 / 1	7	10	0.000	0.251	0.000
2 / 1	8	10	-0.659	0.252	-2.611
2 / 1	9	10	0.552	0.254	2.169
1 / 3	1	11	0.991	0.238	4.160
1 / 3	2	11	0.136	0.260	0.524
1 / 3	3	11	-1.000	0.237	-4.225
1 / 3	4	11	0.278	0.237	1.174
1 / 3	5	11	-0.258	0.270	-0.957
1 / 3	6	11	-0.389	0.237	-1.643
1 / 3	7	10	0.809	0.251	3.228
1 / 3	8	10	-0.068	0.252	-0.270
1 / 3	9	10	-0.460	0.254	-1.808
2 / 3	1	11	0.430	0.238	1.805
2 / 3	2	11	0.816	0.260	3.141
2 / 3	3	11	-0.444	0.237	-1.878
2 / 3	4	11	0.167	0.237	0.704
2 / 3	5	11	-0.172	0.270	-0.638
2 / 3	6	11	-0.056	0.237	-0.235
2 / 3	7	10	0.719	0.251	2.869
2 / 3	8	10	-0.386	0.252	-1.530
2 / 3	9	10	-0.092	0.254	-0.362
5 / 4	1	11	-0.261	1.883	-0.138
5 / 4	2	11	-0.053	2.272	-0.023
5 / 4	3	11	0.258	1.866	0.138
5 / 4	4	11	-0.344	1.866	-0.185
5 / 4	5	11	1.000	4.259	0.235
5 / 4	6	11	0.258	1.866	0.138
5 / 4	7	10	-0.248	1.831	-0.136
5 / 4	8	10	0.151	1.851	0.081
5 / 4	9	10	0.203	1.872	0.109
4 / 6	1	11	0.411	0.238	1.727
4 / 6	2	11	-0.091	0.260	-0.349
4 / 6	3	11	-0.389	0.237	-1.643
4 / 6	4	11	0.815	0.237	3.443
4 / 6	5	11	-0.258	0.270	-0.957
4 / 6	6	11	-1.000	0.237	-4.225
4 / 6	7	10	0.405	0.251	1.614
4 / 6	8	10	-0.114	0.252	-0.450

TABLE 5.26

4 / 6	9	10	-0.092	0.254	-0.362
5 / 6	1	11	-0.261	1.883	-0.138
5 / 6	2	11	-0.053	2.272	-0.023
5 / 6	3	11	0.258	1.866	0.138
5 / 6	4	11	-0.344	1.866	-0.185
5 / 6	5	11	1.000	4.259	0.235
5 / 6	6	11	0.258	1.866	0.138
5 / 6	7	10	-0.248	1.831	-0.136
5 / 6	8	10	0.151	1.851	0.081
5 / 6	9	10	0.203	1.872	0.109
8 / 7	1	10	-0.705	0.252	-2.795
8 / 7	2	10	-0.563	0.274	-2.056
8 / 7	3	10	0.719	0.250	2.874
8 / 7	4	10	-0.405	0.250	-1.616
8 / 7	5	10	0.149	0.285	0.522
8 / 7	6	10	0.405	0.250	1.616
8 / 7	7	10	-0.911	0.248	-3.667
8 / 7	8	10	0.360	0.250	1.437
8 / 7	9	10	0.159	0.252	0.631
7 / 9	1	10	0.932	0.252	3.697
7 / 9	2	10	0.394	0.274	1.439
7 / 9	3	10	-0.944	0.250	-3.772
7 / 9	4	10	0.360	0.250	1.437
7 / 9	5	10	-0.348	0.285	-1.219
7 / 9	6	10	-0.360	0.250	-1.437
7 / 9	7	10	0.867	0.248	3.488
7 / 9	8	10	-0.135	0.250	-0.539
7 / 9	9	10	-0.386	0.252	-1.533
8 / 9	1	10	0.068	0.252	0.271
8 / 9	2	10	-0.563	0.274	-2.056
8 / 9	3	10	-0.045	0.250	-0.180
8 / 9	4	10	0.000	0.250	0.000
8 / 9	5	10	0.050	0.285	0.174
8 / 9	6	10	0.000	0.250	0.000
8 / 9	7	10	-0.156	0.248	-0.626
8 / 9	8	10	0.899	0.250	3.592
8 / 9	9	10	-0.614	0.252	-2.435

TABLE 5.26 (continued)

Correlations of ratios of macerals and microlithotypes of coals and DOM with macerals and microlithotypes of coals and DOM, Patchawarra Formation, second cycle, Tindilpie 1.

		nobs	tau	sd	z
1 / 3	2 / 1	11	-0.296	0.237	-1.252
2 / 3	2 / 1	11	0.259	0.237	1.095
2 / 3	1 / 3	11	0.444	0.237	1.878
5 / 4	2 / 1	11	0.086	1.866	0.046
5 / 4	1 / 3	11	-0.258	1.866	-0.138
5 / 4	2 / 3	11	-0.172	1.866	-0.092
4 / 6	2 / 1	11	-0.204	0.237	-0.861
4 / 6	1 / 3	11	0.389	0.237	1.643
4 / 6	2 / 3	11	0.056	0.237	0.235
4 / 6	5 / 4	11	-0.258	0.270	-0.957
5 / 6	2 / 1	11	0.086	1.866	0.046
5 / 6	1 / 3	11	-0.258	1.866	-0.138
5 / 6	2 / 3	11	-0.172	1.866	-0.092
5 / 6	5 / 4	11	1.000	4.259	0.235
5 / 6	4 / 6	11	-0.258	1.866	-0.138
8 / 7	2 / 1	10	-0.090	0.250	-0.359
8 / 7	1 / 3	10	-0.719	0.250	-2.874
8 / 7	2 / 3	10	-0.719	0.250	-2.874
8 / 7	5 / 4	10	0.149	0.285	0.522
8 / 7	4 / 6	10	-0.405	0.250	-1.616
8 / 7	5 / 6	10	0.149	0.285	0.522
7 / 9	2 / 1	10	-0.135	0.250	-0.539
7 / 9	1 / 3	10	0.944	0.250	3.772
7 / 9	2 / 3	10	0.674	0.250	2.694
7 / 9	5 / 4	10	-0.348	0.285	-1.219
7 / 9	4 / 6	10	0.360	0.250	1.437
7 / 9	5 / 6	10	-0.348	0.285	-1.219
7 / 9	8 / 7	10	-0.778	0.248	-3.130
8 / 9	2 / 1	10	-0.674	0.250	-2.694
8 / 9	1 / 3	10	0.045	0.250	0.180
8 / 9	2 / 3	10	-0.315	0.250	-1.257
8 / 9	5 / 4	10	0.050	0.285	0.174
8 / 9	4 / 6	10	0.000	0.250	0.000
8 / 9	5 / 6	10	0.050	0.285	0.174
8 / 9	8 / 7	10	0.244	0.248	0.984
8 / 9	7 / 9	10	-0.022	0.248	-0.089

TABLE 5.27 Correlations of ratios of macerals and microlithotypes of coals and DOM, Patchawarra Formation, second cycle, Tindilpie 1.

		nobs	tau	sd	z	
2	1	19	0.389	0.177	2.204	
3	1	19	-0.865	0.171	-5.063	
3	2	19	-0.554	0.174	-3.185	
4	1	19	0.181	0.172	1.055	
4	2	19	0.037	0.175	0.212	
4	3	19	-0.163	0.172	-0.948	
5	1	19	0.571	0.175	3.260	*
5	2	19	0.415	0.178	2.329	*
5	3	19	-0.563	0.175	-3.222	*
5	4	19	-0.055	0.175	-0.316	
6	1	19	-0.633	0.171	-3.692	*
6	2	19	-0.259	0.174	-1.487	
6	3	19	0.541	0.171	3.162	*
6	4	19	-0.465	0.172	-2.709	
6	5	19	-0.515	0.174	-2.970	
7	1	15	0.591	0.197	2.995	
7	2	15	0.510	0.200	2.557	
7	3	15	-0.605	0.196	-3.085	
7	4	15	-0.236	0.197	-1.198	
7	5	15	0.530	0.200	2.658	*
7	6	15	-0.312	0.196	-1.593	
8	1	15	0.577	0.199	2.895	
8	2	15	0.455	0.201	2.256	
8	3	15	-0.571	0.198	-2.885	
8	4	15	0.289	0.199	1.447	
8	5	15	0.465	0.201	2.307	*
8	6	15	-0.542	0.198	-2.738	*
8	7	15	0.226	0.197	1.143	
9	1	15	-0.794	0.197	-4.041	
9	2	15	-0.597	0.199	-3.007	
9	3	15	0.786	0.195	4.027	
9	4	15	-0.108	0.197	-0.549	
9	5	15	-0.657	0.199	-3.308	*
9	6	15	0.689	0.195	3.533	*
9	7	15	-0.560	0.195	-2.880	
9	8	15	-0.683	0.196	-3.485	

TABLE 5.28 Correlation of DOM macerals (4,5,6) with coal macerals and microlithotypes (7,8,9) in Patchawarra Formation third cycle, Tindilpie 1.

1 = V_C	4 = V_D	7 = V+C
2 = E_C	5 = E_D	8 = In
3 = I_C	6 = I_D	9 = D+I

* significant correlation

		nobs	tau	sd	z	
2 / 1	1	19	0.190	0.169	1.123	
2 / 1	2	19	0.852	0.172	4.948	
2 / 1	3	19	-0.349	0.169	-2.069	
2 / 1	4	19	-0.006	0.169	-0.035	
2 / 1	5	19	0.278	0.171	1.624	
2 / 1	6	19	-0.142	0.169	-0.843	
2 / 1	7	15	0.394	0.194	2.034	
2 / 1	8	15	0.398	0.195	2.039	
2 / 1	9	15	-0.478	0.193	-2.477	
1 / 3	1	19	0.926	0.169	5.477	
1 / 3	2	19	0.475	0.172	2.757	
1 / 3	3	19	-0.941	0.169	-5.576	
1 / 3	4	19	0.196	0.169	1.159	
1 / 3	5	19	0.532	0.171	3.106	*
1 / 3	6	19	-0.594	0.169	-3.511	*
1 / 3	7	15	0.587	0.194	3.026	
1 / 3	8	15	0.554	0.195	2.835	
1 / 3	9	15	-0.804	0.193	-4.162	
2 / 3	1	19	0.499	0.169	2.949	
2 / 3	2	19	0.913	0.172	5.301	
2 / 3	3	19	-0.657	0.169	-3.893	
2 / 3	4	19	0.125	0.169	0.738	
2 / 3	5	19	0.447	0.171	2.612	*
2 / 3	6	19	-0.356	0.169	-2.106	*
2 / 3	7	15	0.510	0.194	2.629	
2 / 3	8	15	0.534	0.195	2.735	
2 / 3	9	15	-0.689	0.193	-3.567	
5 / 4	1	19	0.287	0.170	1.687	
5 / 4	2	19	0.288	0.173	1.663	
5 / 4	3	19	-0.315	0.170	-1.861	
5 / 4	4	19	-0.371	0.170	-2.180	
5 / 4	5	19	0.705	0.172	4.098	
5 / 4	6	19	-0.185	0.170	-1.089	
5 / 4	7	15	0.553	0.195	2.832	*
5 / 4	8	15	0.333	0.197	1.694	
5 / 4	9	15	-0.522	0.195	-2.680	*
4 / 6	1	19	0.363	0.169	2.143	*
4 / 6	2	19	0.177	0.173	1.025	
4 / 6	3	19	-0.309	0.169	-1.825	
4 / 6	4	19	0.794	0.170	4.675	
4 / 6	5	19	0.170	0.172	0.989	
4 / 6	6	19	-0.679	0.169	-4.004	
4 / 6	7	15	0.077	0.195	0.397	
4 / 6	8	15	0.420	0.196	2.141	*

TABLE 5.29

4 / 6	9	15	-0.452	0.194	-2.331	*
5 / 6	1	19	0.573	0.170	3.374	*
5 / 6	2	19	0.386	0.173	2.229	*
5 / 6	3	19	-0.554	0.170	-3.265	*
5 / 6	4	19	0.012	0.170	0.070	
5 / 6	5	19	0.961	0.172	5.582	
5 / 6	6	19	-0.567	0.170	-3.338	
5 / 6	7	15	0.495	0.195	2.534	*
5 / 6	8	15	0.490	0.197	2.491	*
5 / 6	9	15	-0.676	0.195	-3.474	*
8 / 7	1	15	0.000	0.196	0.000	
8 / 7	2	15	-0.089	0.198	-0.451	
8 / 7	3	15	0.019	0.195	0.099	
8 / 7	4	15	0.254	0.196	1.296	
8 / 7	5	15	-0.010	0.198	-0.050	
8 / 7	6	15	-0.116	0.194	-0.597	
8 / 7	7	15	-0.433	0.194	-2.232	
8 / 7	8	15	0.359	0.195	1.840	
8 / 7	9	15	-0.019	0.193	-0.099	
7 / 9	1	15	0.820	0.196	4.186	
7 / 9	2	15	0.585	0.198	2.954	
7 / 9	3	15	-0.850	0.195	-4.371	
7 / 9	4	15	0.039	0.196	0.199	
7 / 9	5	15	0.565	0.198	2.854	*
7 / 9	6	15	-0.541	0.194	-2.784	*
7 / 9	7	15	0.740	0.194	3.820	
7 / 9	8	15	0.495	0.195	2.536	
7 / 9	9	15	-0.823	0.193	-4.261	
8 / 9	1	15	0.683	0.196	3.488	
8 / 9	2	15	0.545	0.198	2.753	
8 / 9	3	15	-0.657	0.195	-3.378	
8 / 9	4	15	0.195	0.196	0.997	
8 / 9	5	15	0.565	0.198	2.854	*
8 / 9	6	15	-0.599	0.194	-3.082	*
8 / 9	7	15	0.375	0.194	1.935	
8 / 9	8	15	0.864	0.195	4.426	
8 / 9	9	15	-0.823	0.193	-4.261	

TABLE 5.29 (continued)

Correlations of ratios of macerals and microlithotypes of coals and DOM with macerals and microlithotypes of coals and DOM, Patchawarra Formation, third cycle, Tindilpie 1.

* significant correlation

		nobs	tau	sd	z	
1 / 3	2 / 1	19	0.275	0.167	1.644	
2 / 3	2 / 1	19	0.696	0.167	4.163	
2 / 3	1 / 3	19	0.579	0.167	3.464	
5 / 4	2 / 1	19	0.241	0.168	1.436	
5 / 4	1 / 3	19	0.276	0.168	1.646	
5 / 4	2 / 3	19	0.300	0.168	1.786	
4 / 6	2 / 1	19	0.082	0.168	0.490	
4 / 6	1 / 3	19	0.364	0.168	2.170	*
4 / 6	2 / 3	19	0.270	0.168	1.610	
4 / 6	5 / 4	19	-0.147	0.168	-0.876	
5 / 6	2 / 1	19	0.265	0.168	1.576	
5 / 6	1 / 3	19	0.535	0.168	3.187	*
5 / 6	2 / 3	19	0.418	0.168	2.486	*
5 / 6	5 / 4	19	0.621	0.169	3.682	
5 / 6	4 / 6	19	0.230	0.168	1.367	
8 / 7	2 / 1	15	-0.048	0.192	-0.247	
8 / 7	1 / 3	15	-0.010	0.192	-0.049	
8 / 7	2 / 3	15	-0.029	0.192	-0.148	
8 / 7	5 / 4	15	-0.067	0.194	-0.347	
8 / 7	4 / 6	15	0.191	0.193	0.991	
8 / 7	5 / 6	15	0.010	0.194	0.050	
7 / 9	2 / 1	15	0.467	0.192	2.425	
7 / 9	1 / 3	15	0.848	0.192	4.404	
7 / 9	2 / 3	15	0.676	0.192	3.514	
7 / 9	5 / 4	15	0.452	0.194	2.332	*
7 / 9	4 / 6	15	0.345	0.193	1.784	
7 / 9	5 / 6	15	0.567	0.194	2.927	*
7 / 9	8 / 7	15	-0.162	0.192	-0.841	
8 / 9	2 / 1	15	0.448	0.192	2.326	
8 / 9	1 / 3	15	0.638	0.192	3.316	
8 / 9	2 / 3	15	0.619	0.192	3.217	
8 / 9	5 / 4	15	0.433	0.194	2.232	*
8 / 9	4 / 6	15	0.402	0.193	2.081	*
8 / 9	5 / 6	15	0.587	0.194	3.026	*
8 / 9	8 / 7	15	0.200	0.192	1.039	
8 / 9	7 / 9	15	0.638	0.192	3.316	

TABLE 5.30 Correlation of ratios of macerals and microlithotypes in coals and DOM, Patchawarra Formation, third cycle, Tindilpie 1.

* significant correlation

6. PETROLOGY OF ORGANIC MATTER IN THE PEDIRKA AND SIMPSON DESERT BASINS

6. (i) Introduction

The Pedirka Basin lies to the west of the Cooper Basin (Fig.6.1) and contains Permian sediments equivalent in age to those in the Cooper Basin (Fig.6.2). In 1977 the Poolowanna 1 and Macumba 1 wells were drilled in the Pedirka Basin region by Delhi Petroleum Pty.Ltd. (Fig.6.3), and hydrocarbon shows were found in Lower Jurassic reservoirs in Poolowanna 1 (Fig.6.4). These Lower Jurassic rocks are part of the Eromanga Basin sequence and have a $\bar{R}_{o\ max}$ of more than 0.75% over a wide area (Moore, 1982, Kantsler et al., 1983).

Cuttings from Poolowanna 1 and Macumba 1 from the Lower Permian to the Cretaceous were supplied by Delhi Petroleum Pty.Ltd. The stratigraphic sequences in these wells are shown in Fig.6.5. A petrological study of the cuttings was undertaken to determine the potential of the sediments as source rocks for hydrocarbons.

Permian core and cutting samples from two other wells, Purni 1 and Mokari 1 (Fig.6.3) were also supplied by Delhi for study. The stratigraphic sequences in these wells are given in Fig.6.6.

6. (ii) Petrographic Analyses

Cuttings of 3.1 m (10 ft) intervals from the Permian section in Macumba 1 and the Triassic sections in Macumba 1 and Poolowanna 1 were selected on the basis of their containing coal and/or dark shale particles. Samples from Poolowanna 1 were froth floated to concentrate the organic matter.

Grain mounts of the cuttings from the four wells, and polished blocks and thin sections of the core samples from Purni 1 and Mokari 1, were examined with reflected light, both in white light mode using plane

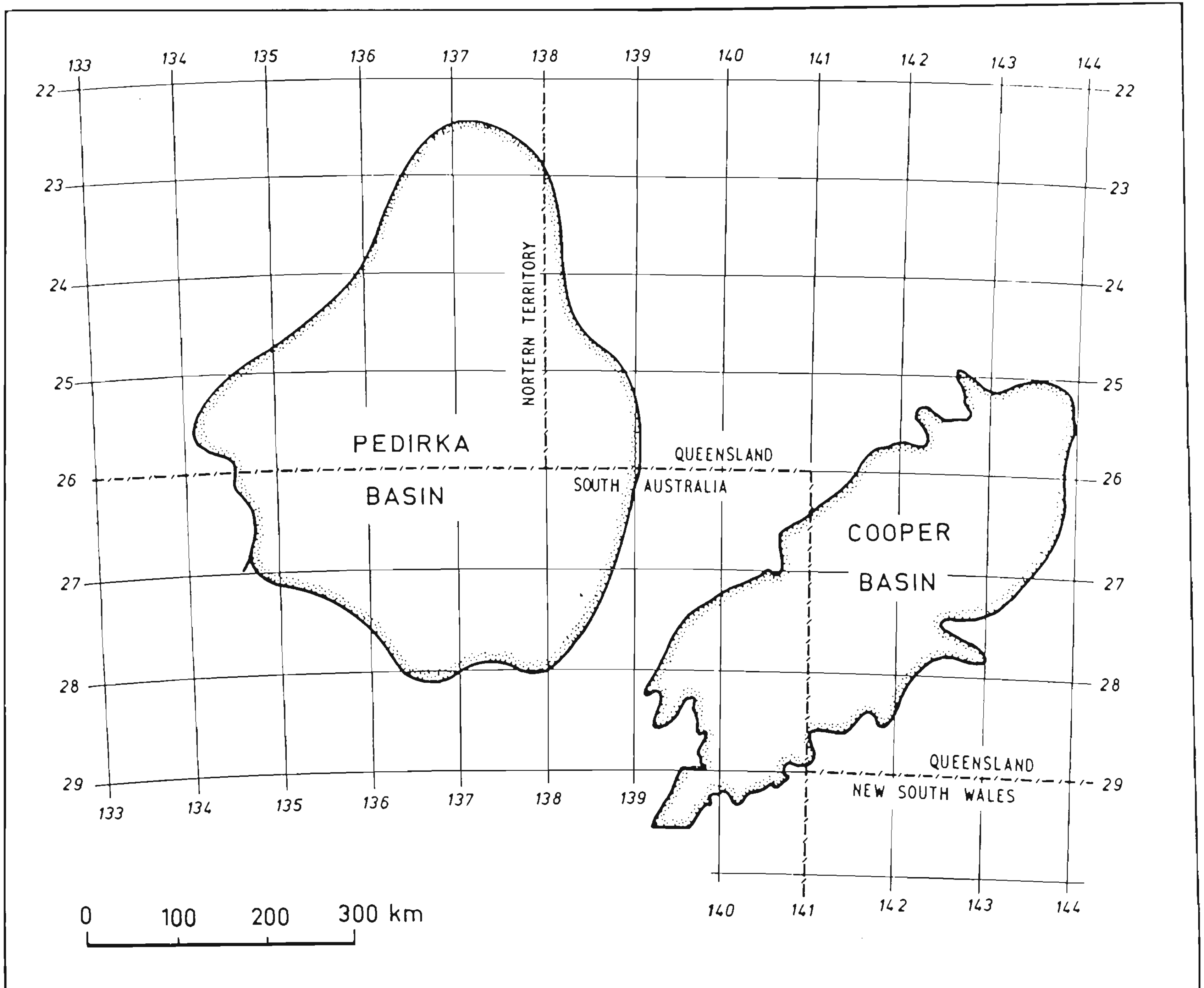


FIG. 6.1 LOCATION OF PEDIRKA AND COOPER BASINS

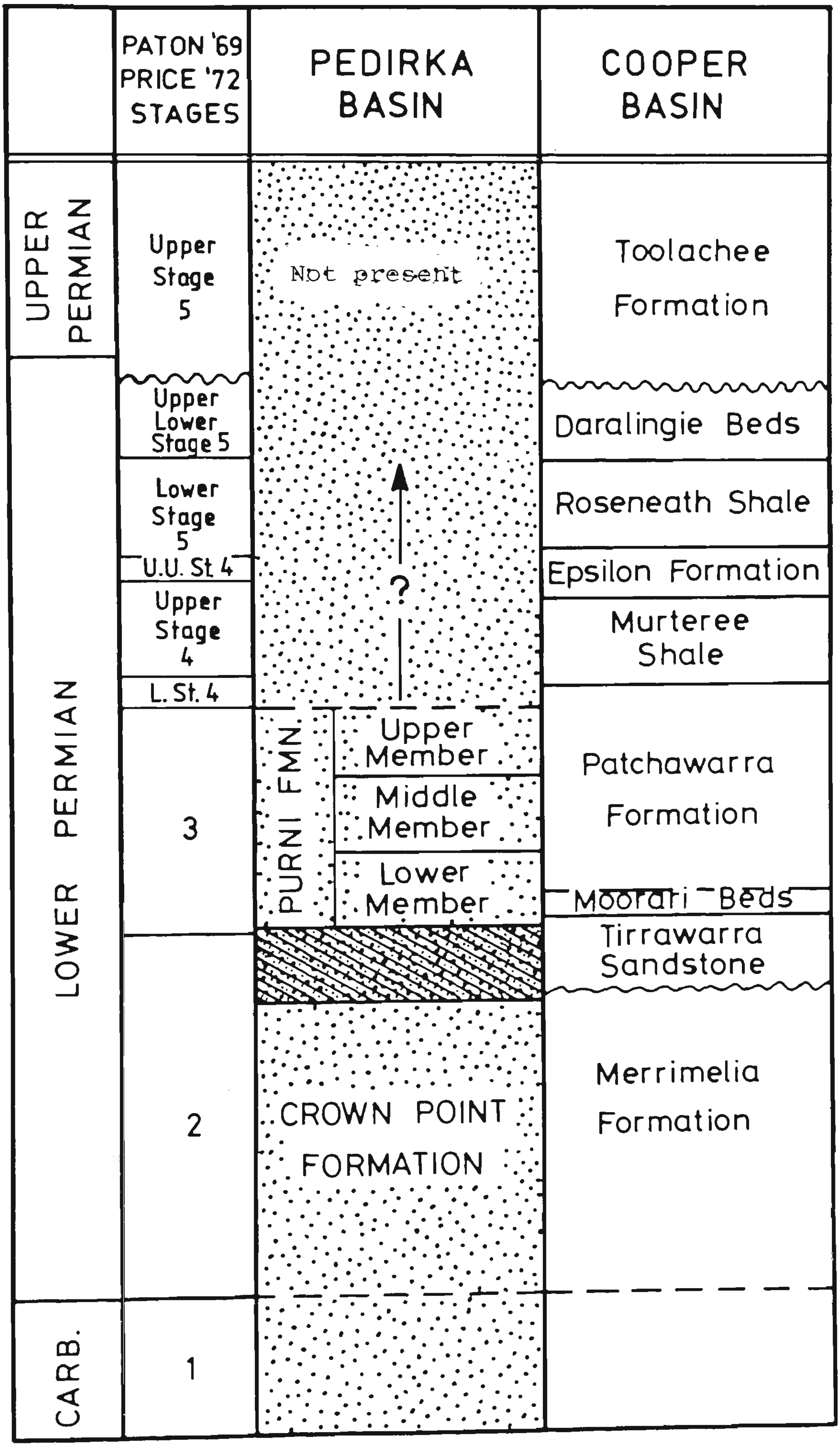


Fig.6.2 PERMIAN STRATIGRAPHY IN THE PEDIRKA AND COOPER BASINS

(After Porter 1978)

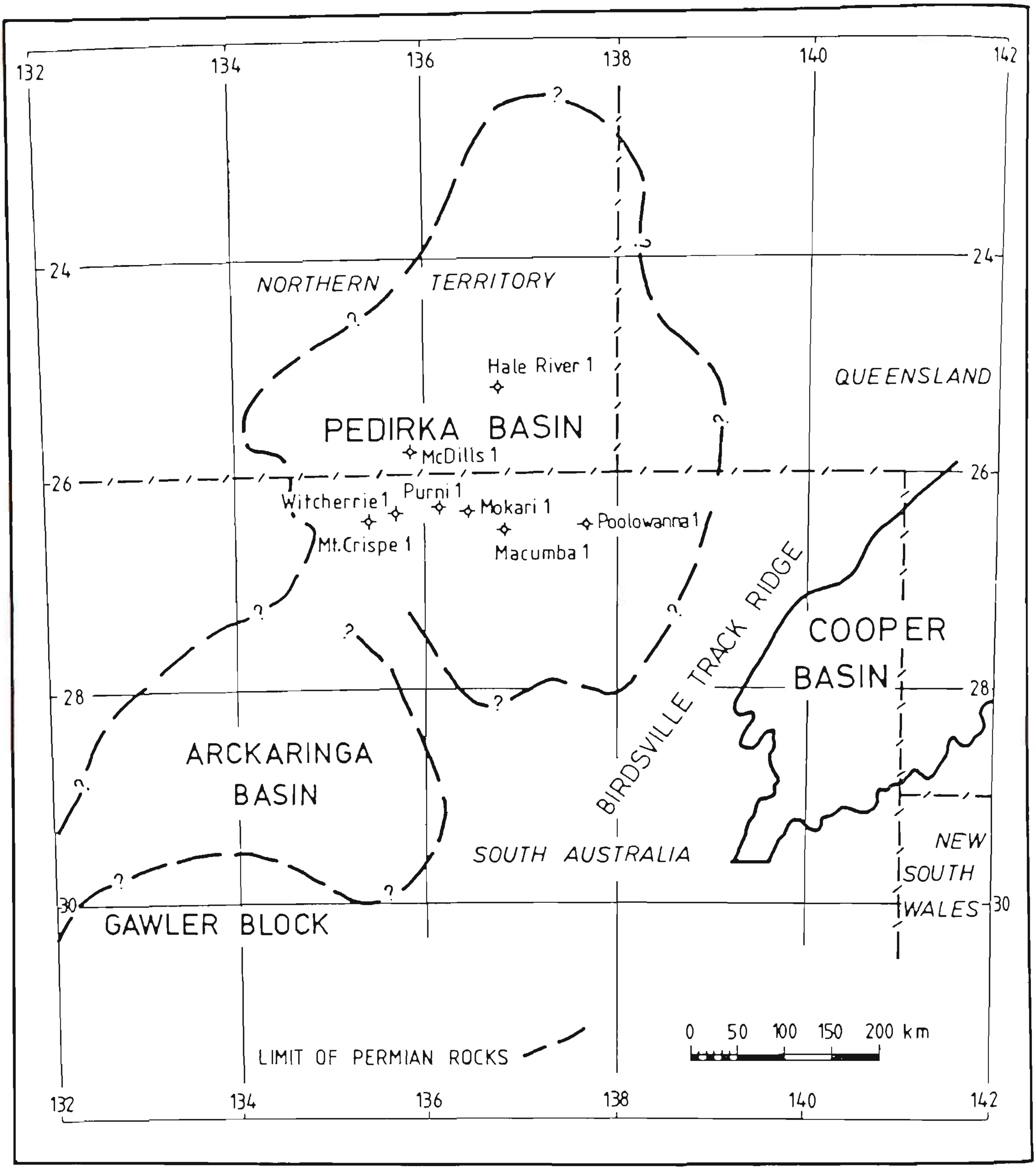


Fig. 6.3 LOCATION OF WELLS IN THE PEDIRKA BASIN

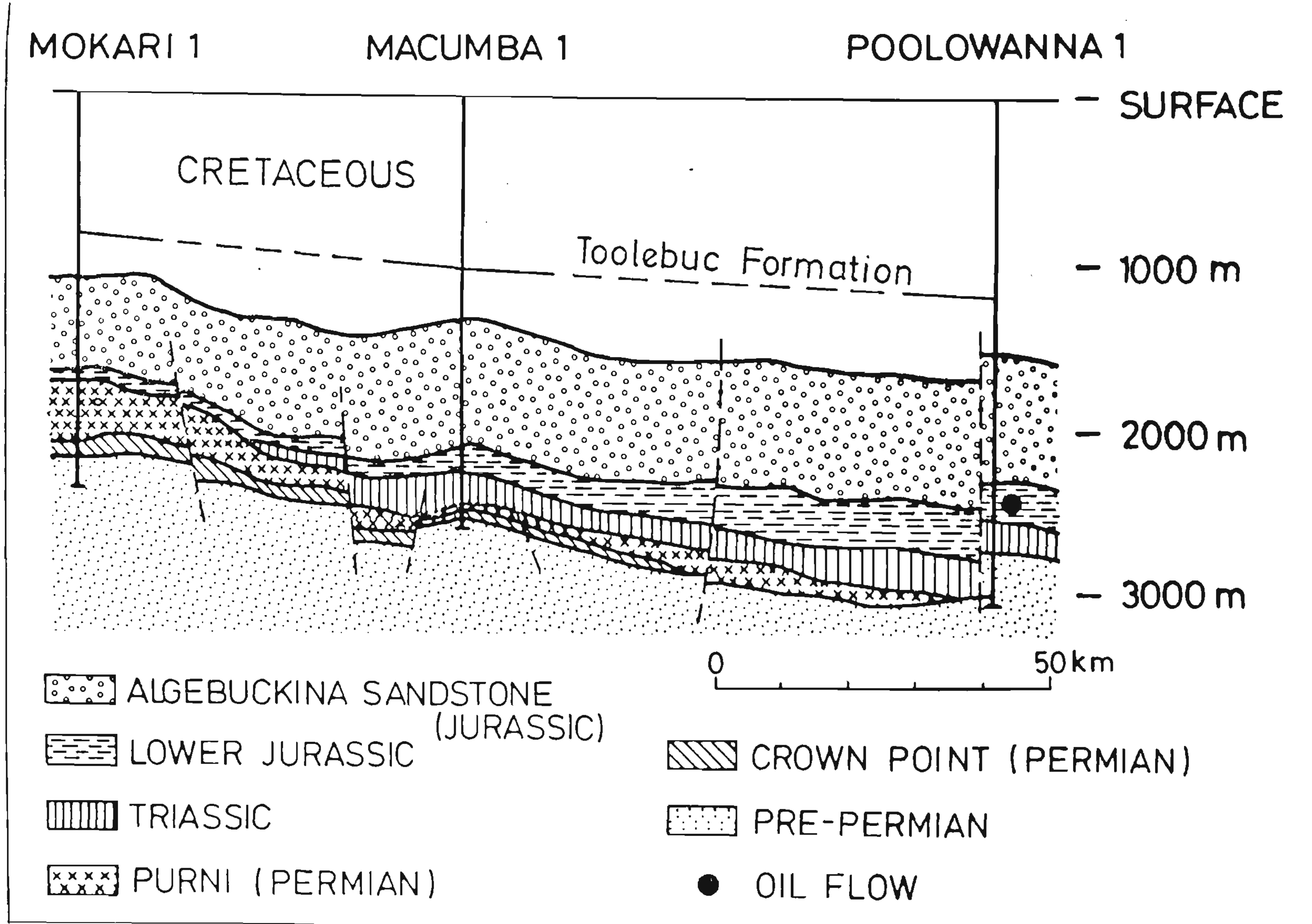


FIG 6.4 Cross section Pedirka, Simpson Desert and Eromanga Basins (after Porter, 1978)

polarised light and in fluorescence mode.

Maceral analyses were carried out on all grain mounts, and where sufficient coal particles were present, microlithotype analyses also.

6. (iii) Results of petrographic analyses

Results of the maceral analyses on the Lower Permian Purni Formation samples in Mokari 1 and Purni 1 are given in Table 6.1, and those from Macumba 1 in Table 6.3. Tables 6.1 to 6.9 are in the Appendix. Fig.6.7 shows the maceral compositions of the Purni Formation coals from Mokari 1, Purni 1 and Macumba 1. These coals show a range in petrographic composition from 30 to 69% vitrinite and 19 to 71% inertinite (mineral matter free). All contain less than 25% exinite, but have a higher exinite content than is found in most other Australian Permian coals.

Descriptions of the cores from Mokari 1 and Purni 1 are summarised in Table 6.2 and are given in Appendix 6.1.

Lower Permian DOM in Macumba 1 (Fig.6.8) contains more inertinite (4%-80%) and less vitrinite (7-38%) than the associated coals (inertinite 28-63%), vitrinite 27-61%), with exinite 0-33% in the DOM, 0-20% in the coals.

The maceral compositions of Triassic coals from the Peera Peera Formation in Macumba 1 and Poolowanna 1 are plotted in Fig.6.9 and are given in Tables 6.4 and 6.5. These coals have 6-77% vitrinite, 23-85% inertinite and 0-50% exinite. Some coals have an extremely high exinite content when compared with other Australian Triassic coals, but do not occur in well-defined seams as do the Permian coals.

DOM in the Triassic section at Macumba 1 and Poolowanna 1 has a petrographic composition of 6-59% vitrinite, 0-60% exinite, and 30-82% inertinite. The Triassic DOM contains more vitrinite than the Permian

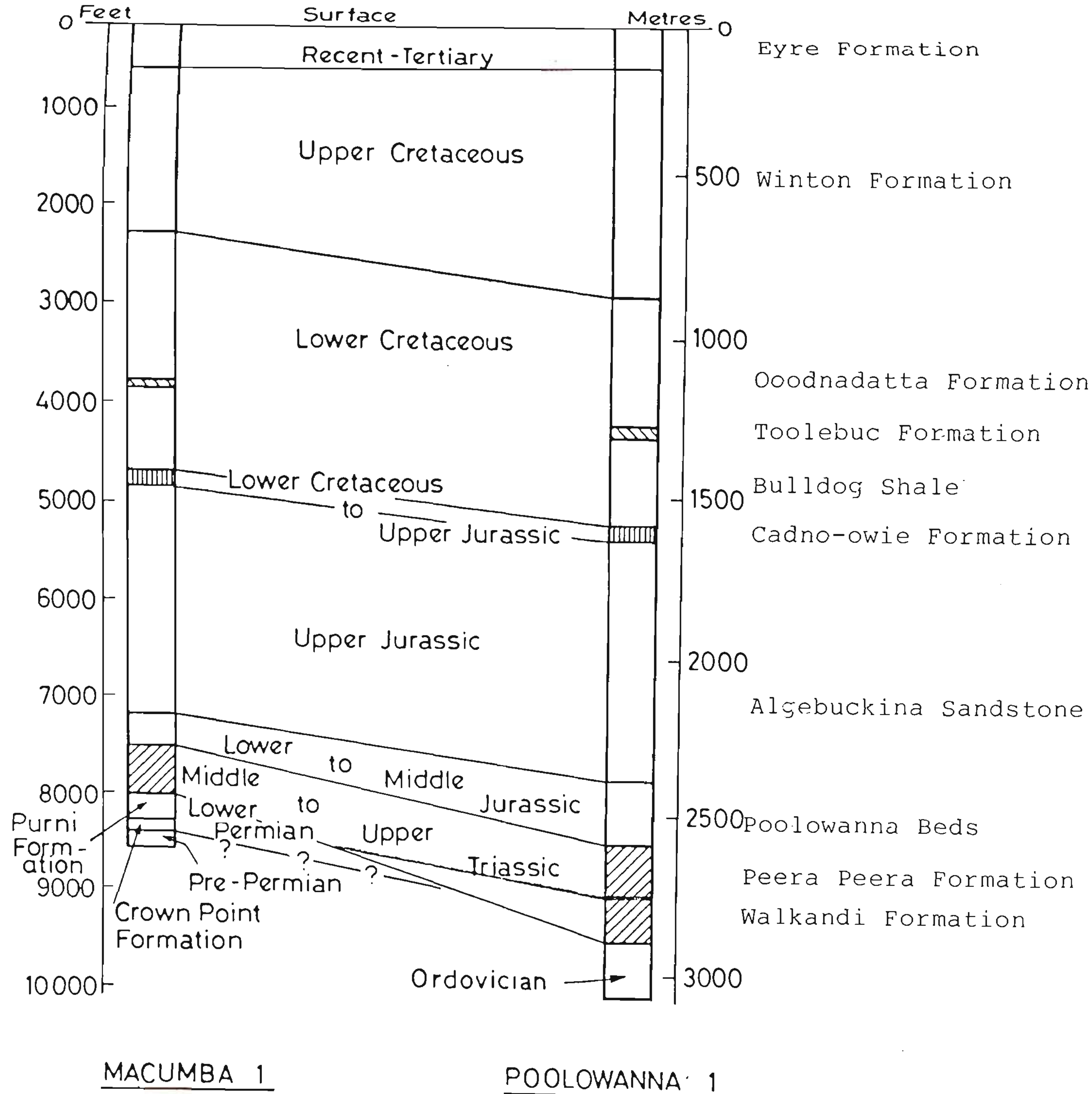
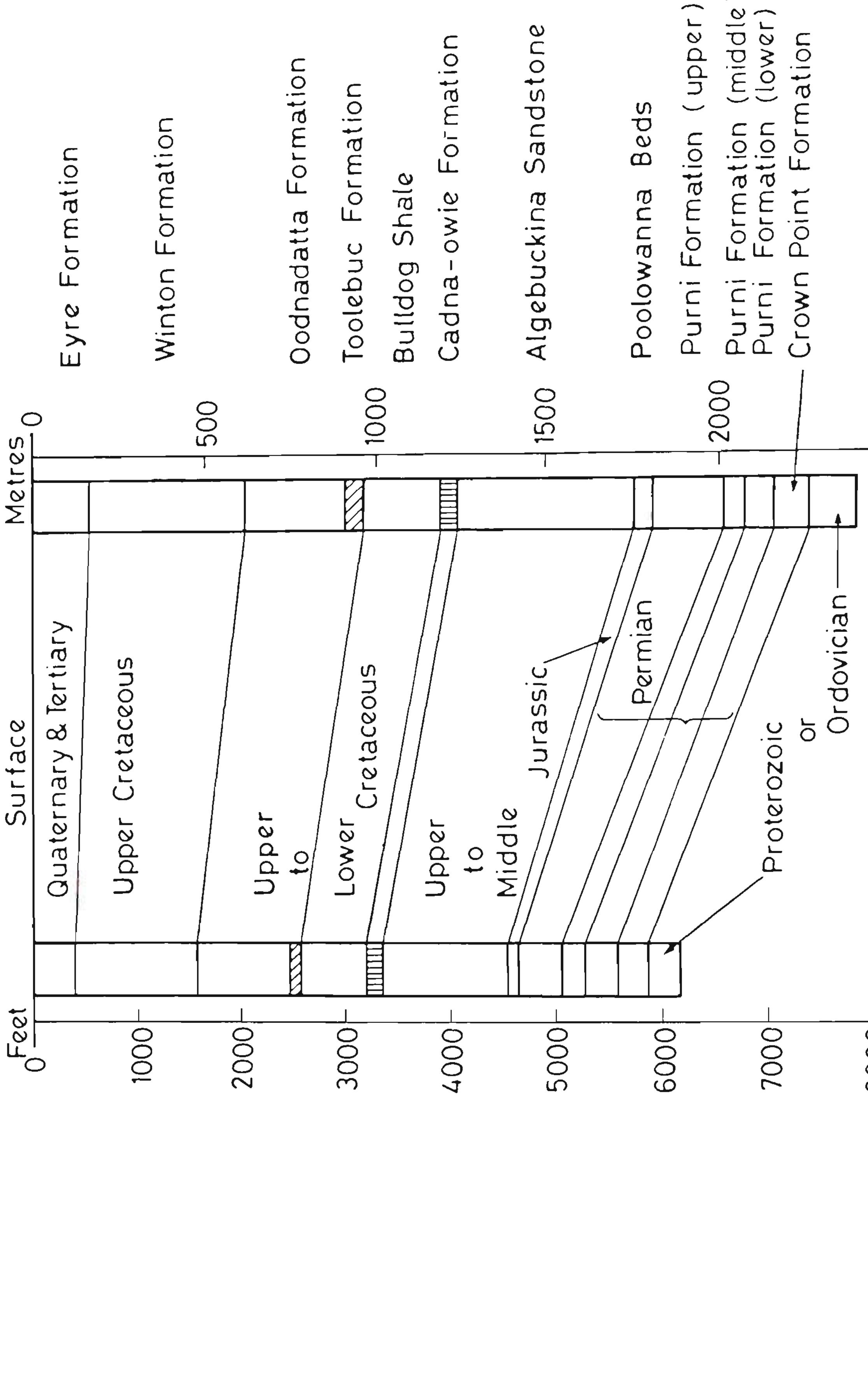


Fig.6.5 Stratigraphic sequences in the wells Macumba 1 and Poolowanna 1



Feet
0
1000
2000
3000
4000
5000
6000
7000
8000
PURNI 1
Surface
Quaternary & Tertiary
Upper Cretaceous
Upper to Lower Cretaceous
Upper to Middle Jurassic
Permian
Proterozoic or Ordovician
Metres
0
500
1000
1500
2000
2500
MOKARI 1
Eyre Formation
Winton Formation
Oodnadatta Formation
Toolebuc Formation
Bulldog Shale
Cadna-owie Formation
Algebuckina Sandstone
Poolowanna Beds
Purni Formation (upper)
Purni Formation (middle)
Purni Formation (lower)
Crown Point Formation

DOM (Fig.6.10).

The components of the exinite maceral group, in Permian and Triassic coals and Triassic DOM, are plotted in Fig.6.11. Triassic exinite DOM comprises 50-100% cutinite. The exinite in Triassic coals is 41-57% cutinite, and exinite in Permian coals is 43-46% cutinite and 40=43% sporinite (Table 6.3).

The components of the inertinite maceral group in the Permian coals and DOM from Macumba 1 are plotted in Fig.6.12. Inertodetrinite (+ macrinite and micrinite) is 40-76% in coals and 60-87% in DOM, and the coals have higher semifusinite and fusinite contents (19-60%, 0-27%, respectively) than the DOM (13-41%, 0-11%, respectively). In Fig.6.13, most Triassic coals and DOM have high inertodetrinite contents (55-86% in coals, 26-94% in DOM), although a few Triassic DOM samples have a higher semifusinite content, 6-65%.

The depths of the samples studied in the sedimentary sequences in Poolowanna 1, Macumba 1, Mokari 1 and Purni 1 are shown in Figs.6.14 to 6.18. These diagrams indicate the amount and type of DOM present, and the microlithotype compositions of the associated coals.

The Permian and Triassic coals show a wide range of microlithotype compositions (Tables 6.6 to 6.8, Fig.6.19). Permian coals from Purni 1 contain 12-59% vitrite plus clarite; those from Mokari 1, 2-48% vitrite plus clarite. Coals from Mokari 1 near the top of the Purni Formation have very low vitrite plus clarite contents (2, 7%) (Fig.6.17). Only one Permian coal sample has been analysed from Macumba 1 and it has 21% vitrite plus clarite and 46% intermediates (duroclarite, clarodurite, vitrinertite) (Fig.6.15). The Permian coals have 12-79% durite plus inertite.

Triassic coals from Poolowanna l have 22-72% vitrite plus clarite. They contain much lower amounts of intermediates (16-19%) than the Permian coals (16-57%) (Fig.6.14).

The proportion of organic material is exaggerated in Poolowanna l because of the froth flotation procedure for concentrating the organic matter. This procedure may also have altered the petrographic composition. The amount of DOM has been estimated only in Mokari l and Purni l. The amount and type of DOM in Macumba l has been counted on the samples "as received" so these results should be representative. The average amount of DOM in the formations is given below.

Peera Peera Formation	1.9%
upper part	3.0%
lower part	1.0%
Purni Formation	1.7%

The average composition of this DOM is

Permian	Triassic	
	lower section	upper section
23% vitrinite	16% vitrinite	20% vitrinite
14% exinite	18% exinite	19% exinite
63% inertinite	66% inertinite	61% inertinite

The potential of the above sediments as sources for hydrocarbons has been discussed in Smyth and Saxby (1981) and Moore (1982). The sediments in the upper part of the Peera Peera Formation probably have the best potential as source rocks, containing the most DOM and having a vitrinite reflectance ($R_{o\ max}$) of approximately 0.80%.

6. (iv) <u>Statistical testing of samples</u>

Only the results from Macumba l for the Purni Formation are in a form suitable for the statistical testing procedures carried out on the data

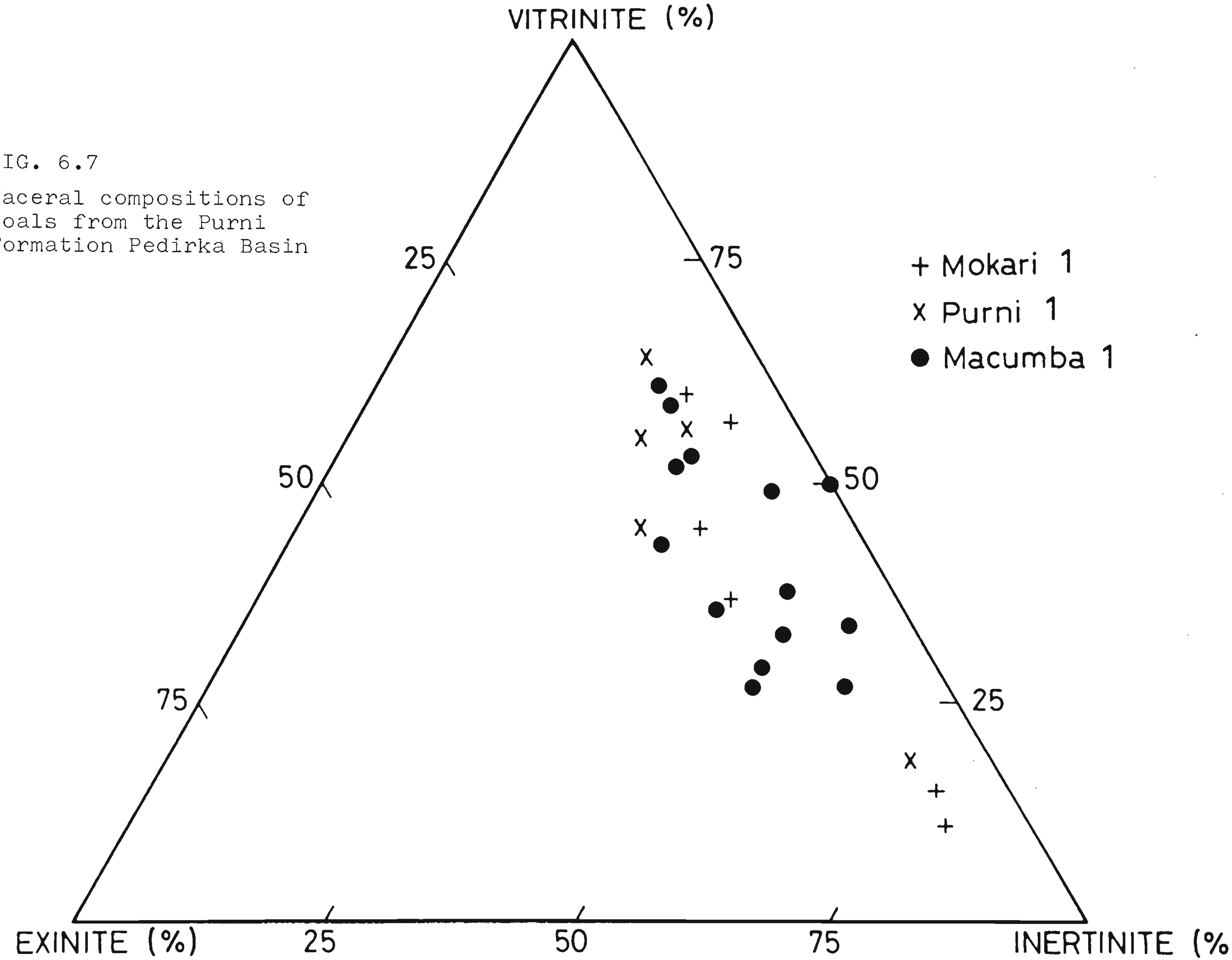
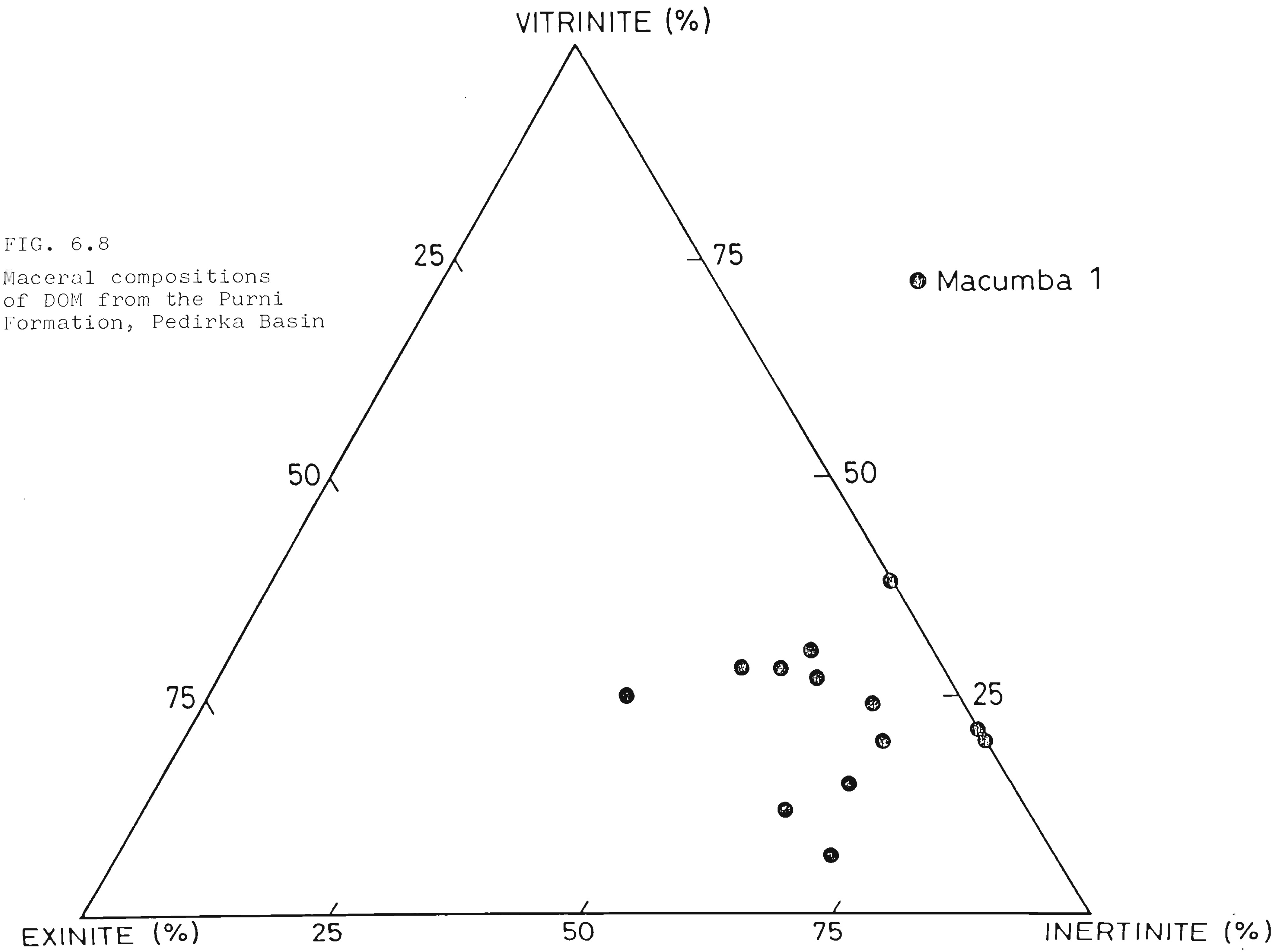


FIG. 6.7

Maceral compositions of coals from the Purni Formation Pedirka Basin

FIG. 6.8

Maceral compositions
of DOM from the Purni
Formation, Pedirka Basin



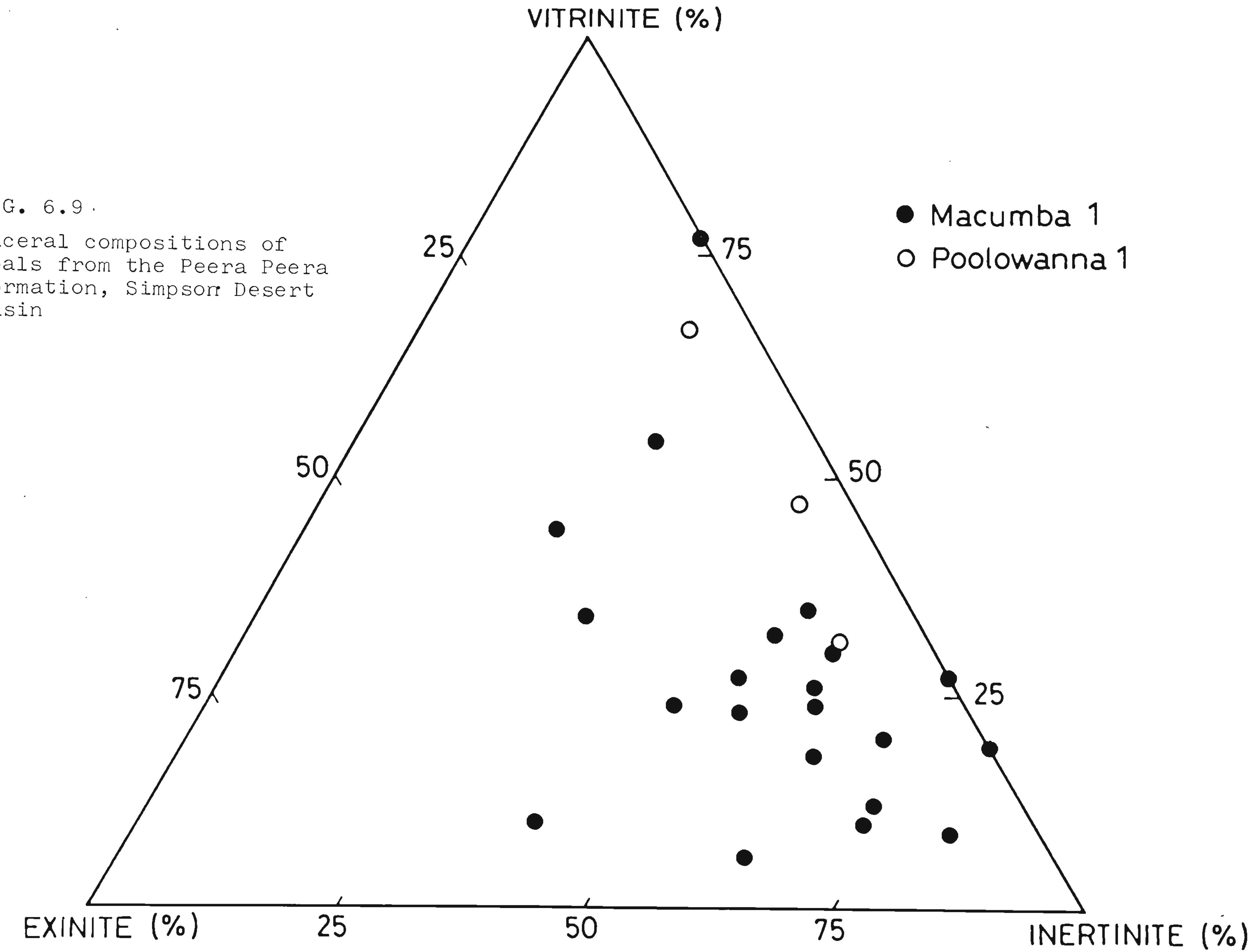


FIG. 6.9

Maceral compositions of coals from the Peera Peera Formation, Simpson Desert Basin

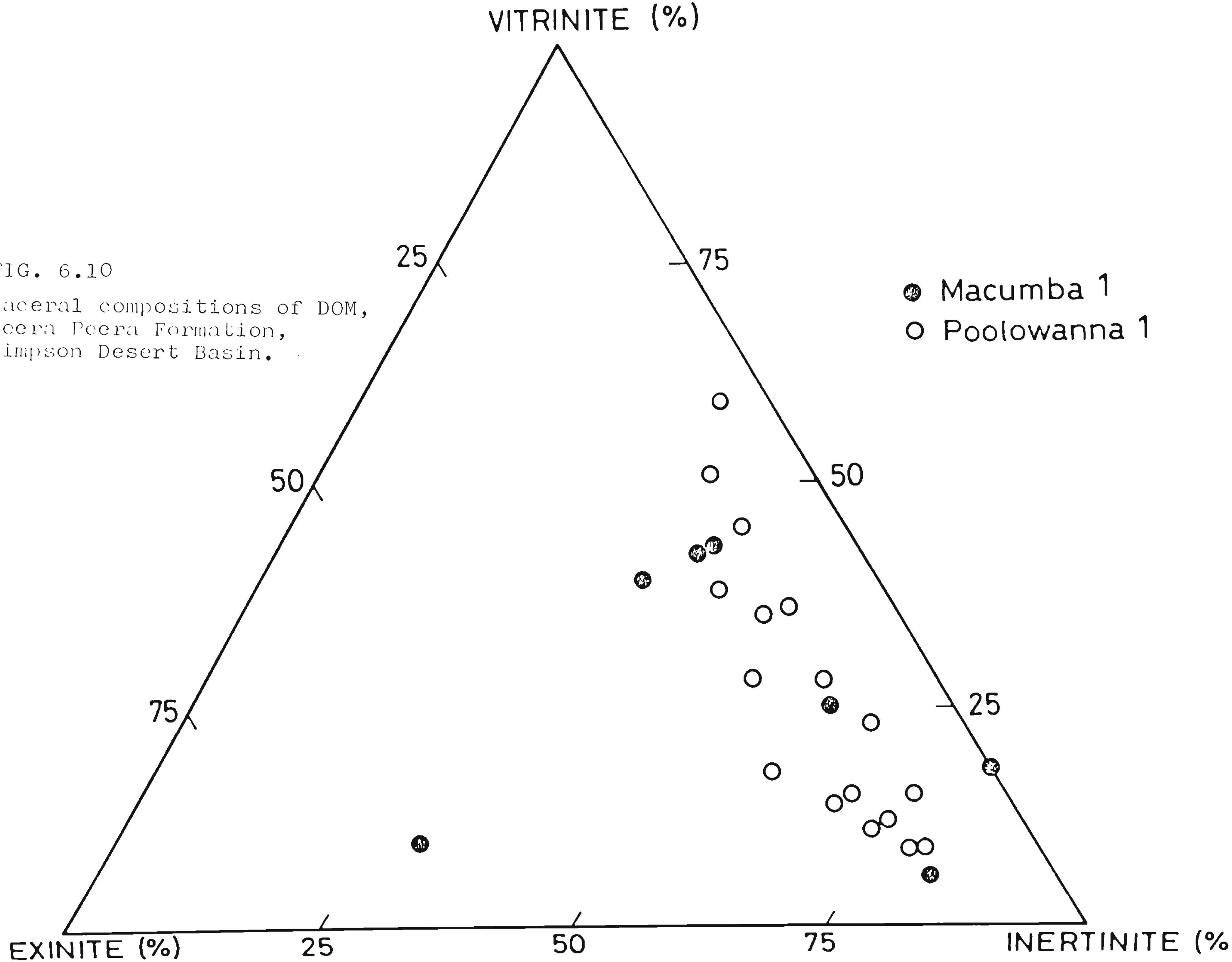


FIG. 6.10

Maceral compositions of DOM, Peera Peera Formation, Simpson Desert Basin.

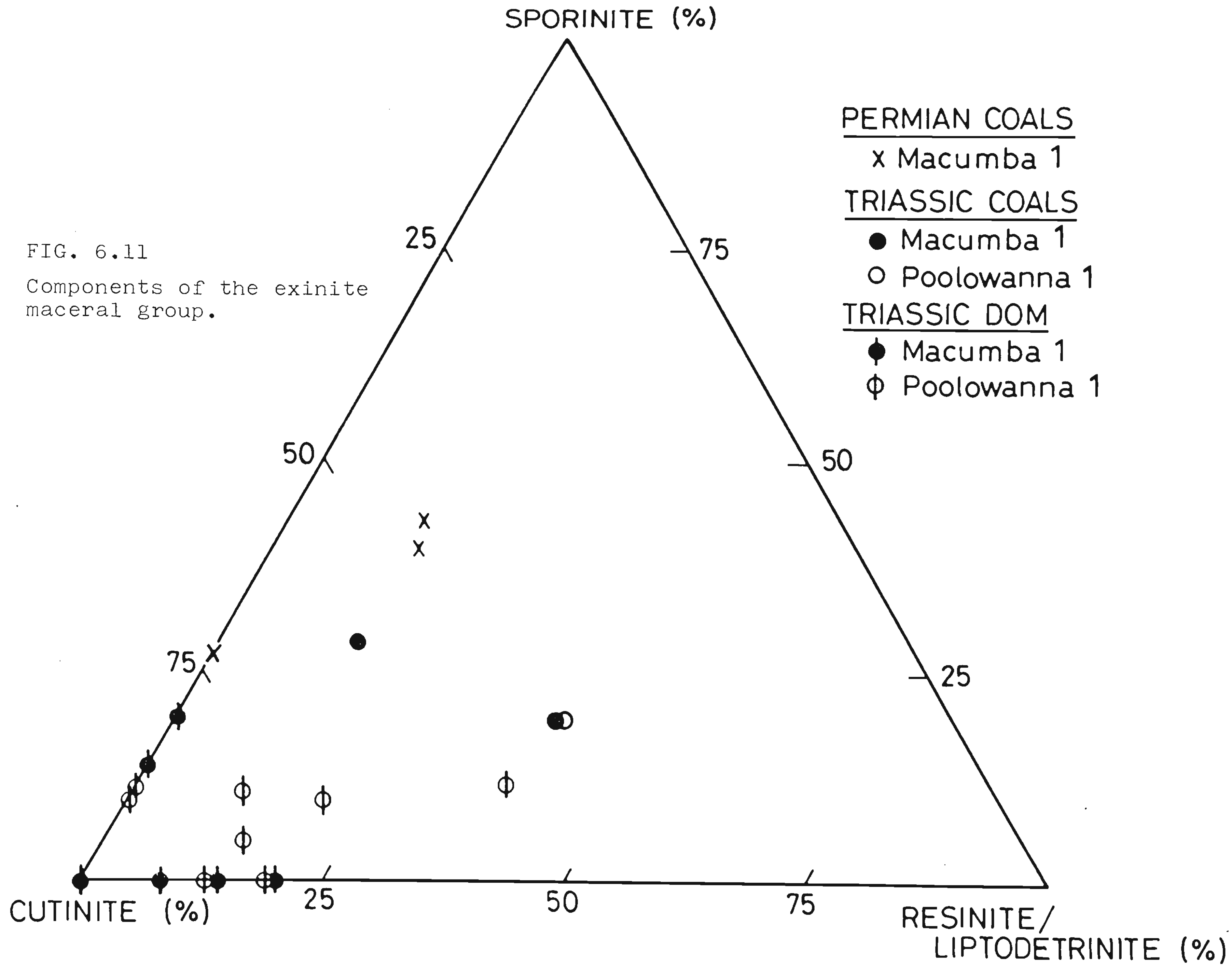


FIG. 6.11

Components of the exinite maceral group.

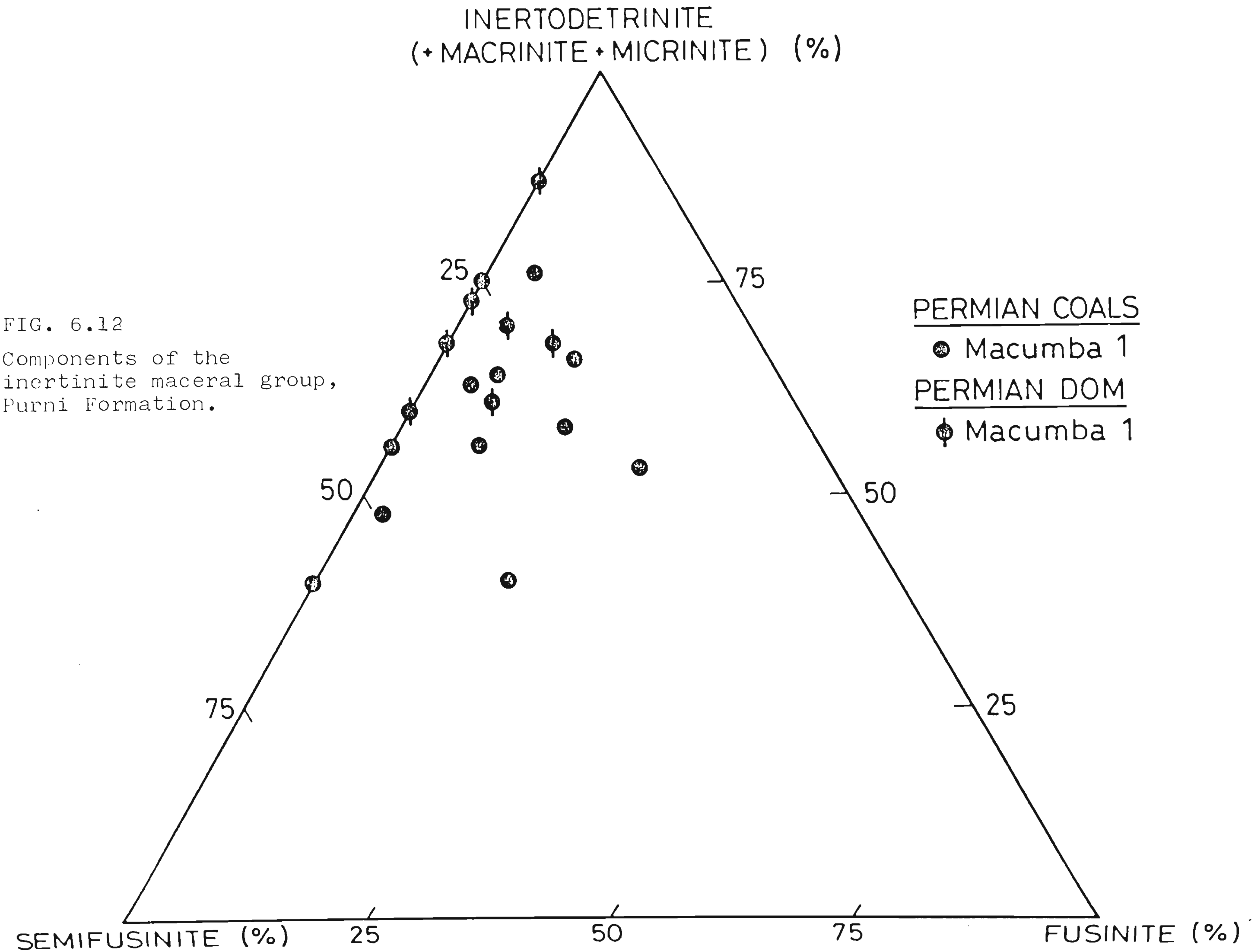


FIG. 6.12

Components of the inertinite maceral group, Purni Formation.

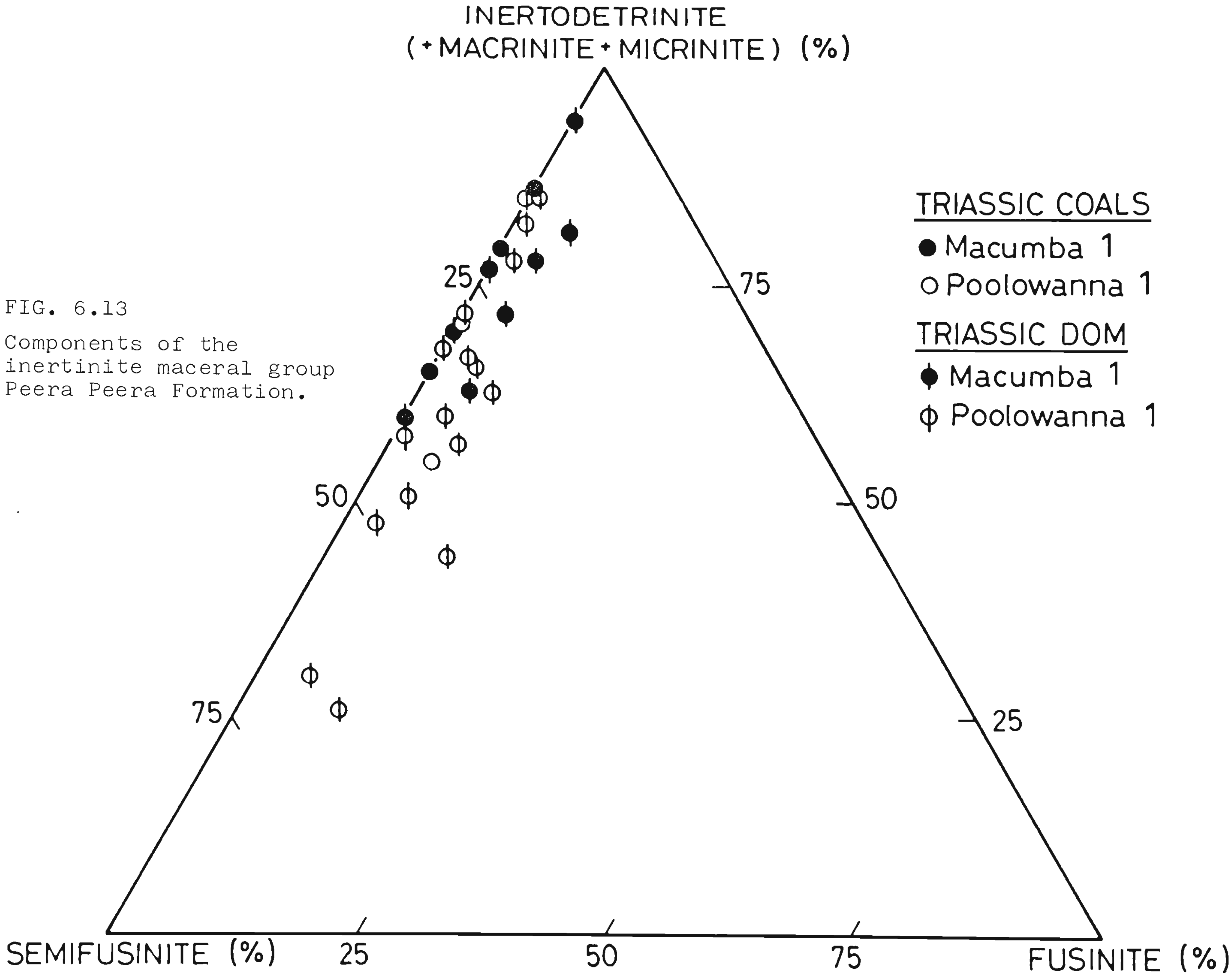


FIG. 6.13

Components of the inertinite maceral group Peera Peera Formation.

from the Mudrangie 1 and Tindilpie 1 samples. In the case of samples from Mokari 1 and Purni 1 the coals but not the DOM were analysed quantitatively. Also, the number of samples analysed was comparatively small.

The results for Macumba 1, Purni Formation, are given in Tables 6.9 to 6.11. Lack of microlithotype analyses means that only the DOM macerals (V_D, E_D, E_D) and macerals in coals (V_c, E_c, I_c) have been tested for correlations. The significant correlations found are both negative and are:

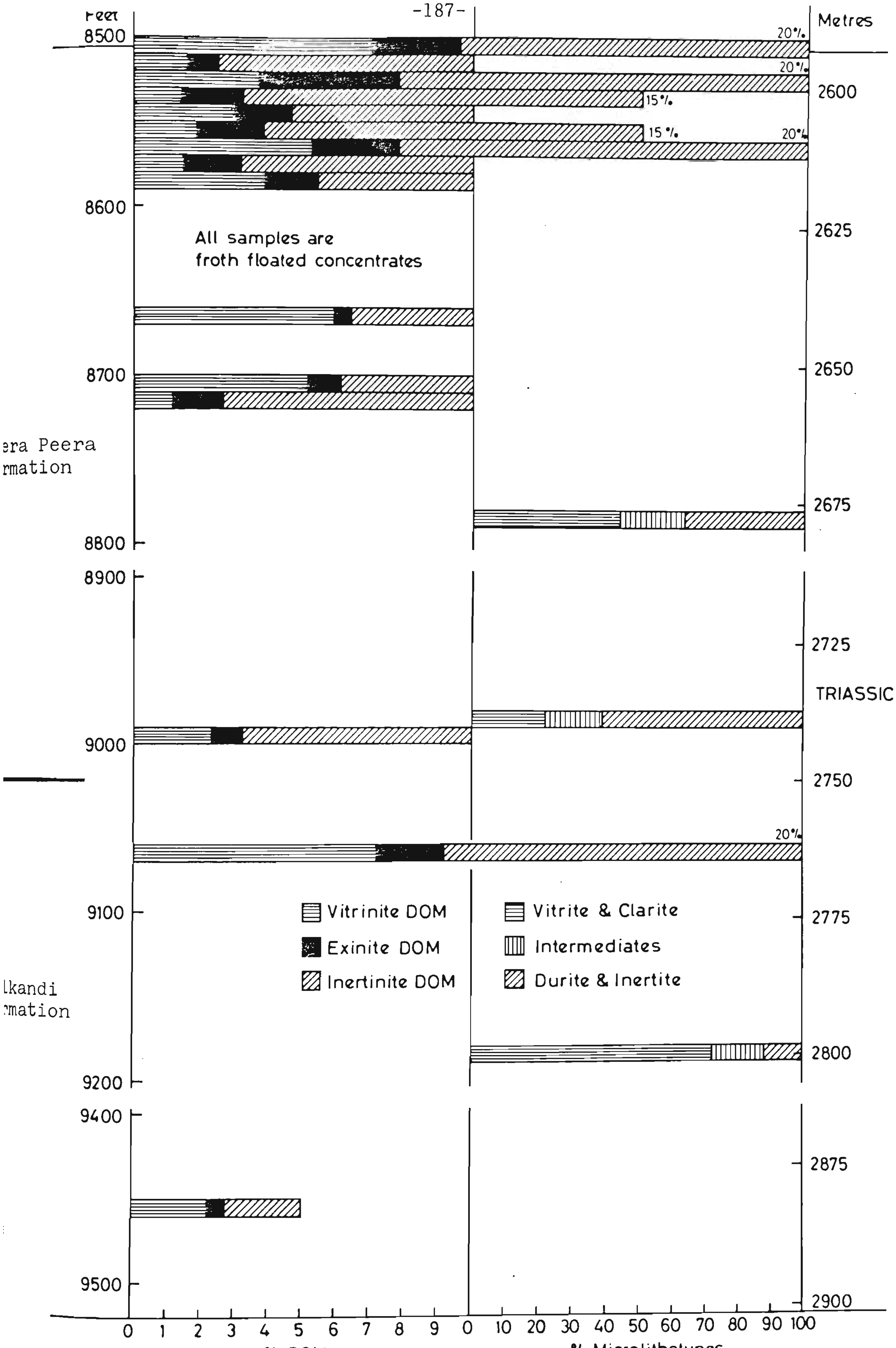
1. V_D with $\frac{E_c}{I_c}$; and
2. E_c with $\frac{V_D}{I_D}$

That is, the amount of vitrinite in the DOM decreases with an increase in the ratio of exinite to inertinite in the associated coal. This relationship was not found in Tindilpie 1. The type of coal in Macumba 1 is not as restricted in maceral composition as in the Cooper Basin wells, but has low to high vitrinite content, and more exinite.

Results from the Peera Peera Formation in Macumba 1 have also been tested. Correlations are given in Tables 6.12 to 6.14. Again the lack of microlithotype analyses means that only DOM macerals and coal macerals have been correlated. None of the correlations is significant.

Results from the froth floated material, Peera Peera Formation, of Poolowanna 1 were tested and results are given in Tables 6.15 to 6.17. None of these correlations is significant.

The Macumba 1 and Poolowanna 1 petrographic results for the Peera Peera Formation were combined and then tested. Results of the combined analyses are given in Tables 6.18 to 6.20. In Table 6.19 the only significant correlation is negative and is between



POOLOWANNA No 1 WELL
SIMPSON DESERT BASIN

FIG. 6.14 Amount and type of DOM, and compositions of associated ...ls (microlithotype)

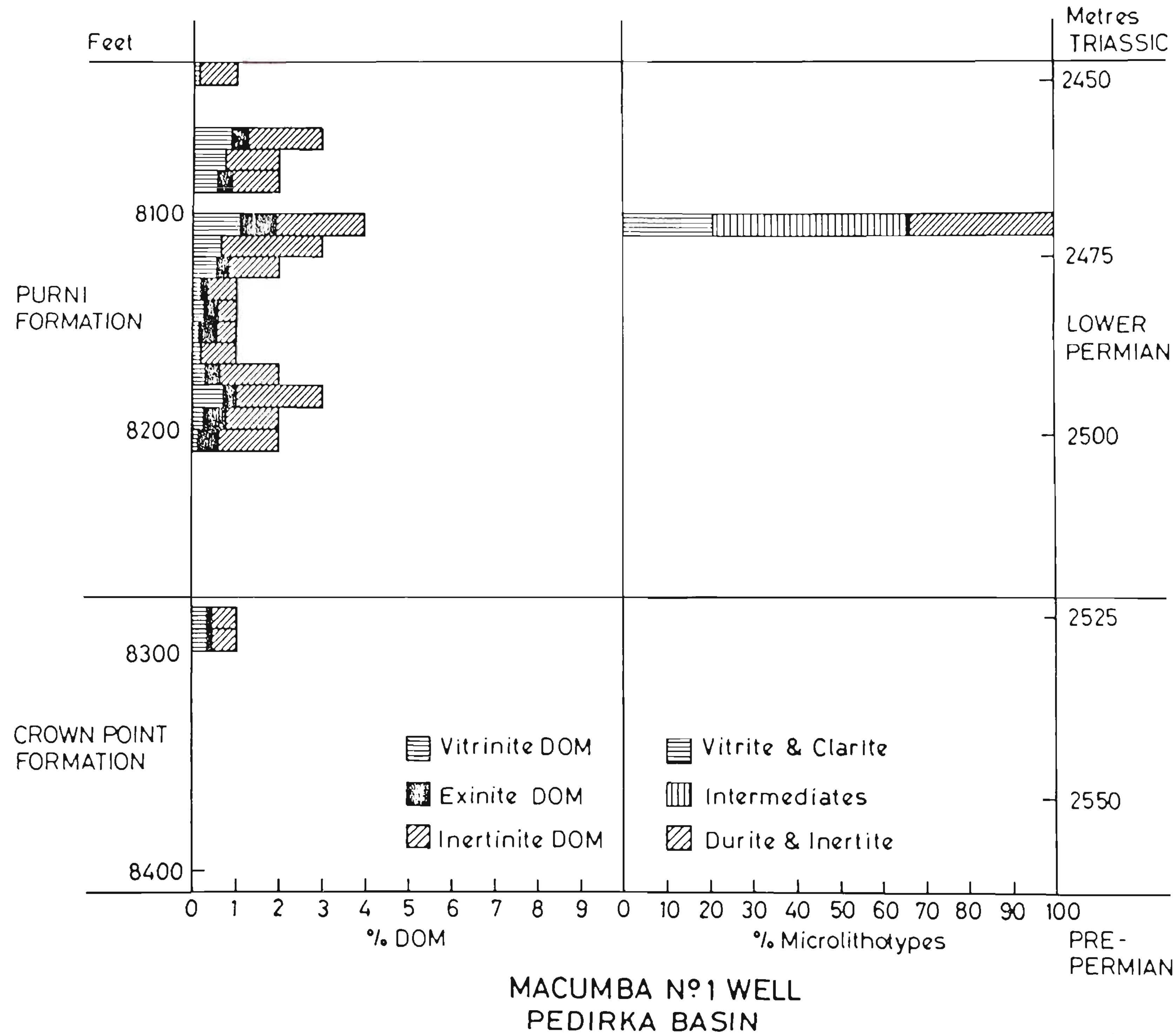
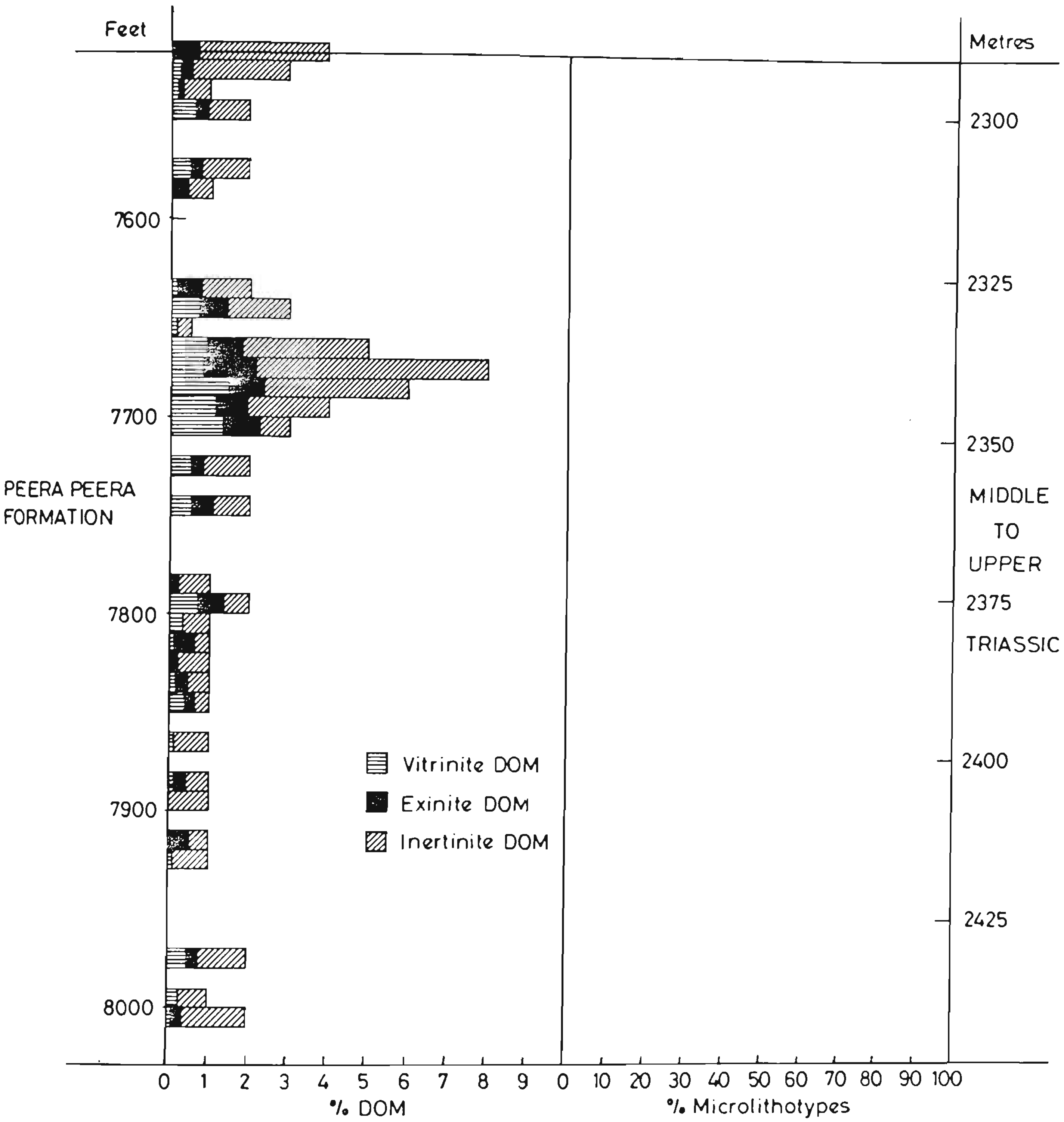


FIG. 6.15 Amount and type of DOM and composition of associated coal (microlithotype:



MACUMBA N°1 WELL

SIMPSON DESERT BASIN

FIG. 6.16 Amount and type of DOM

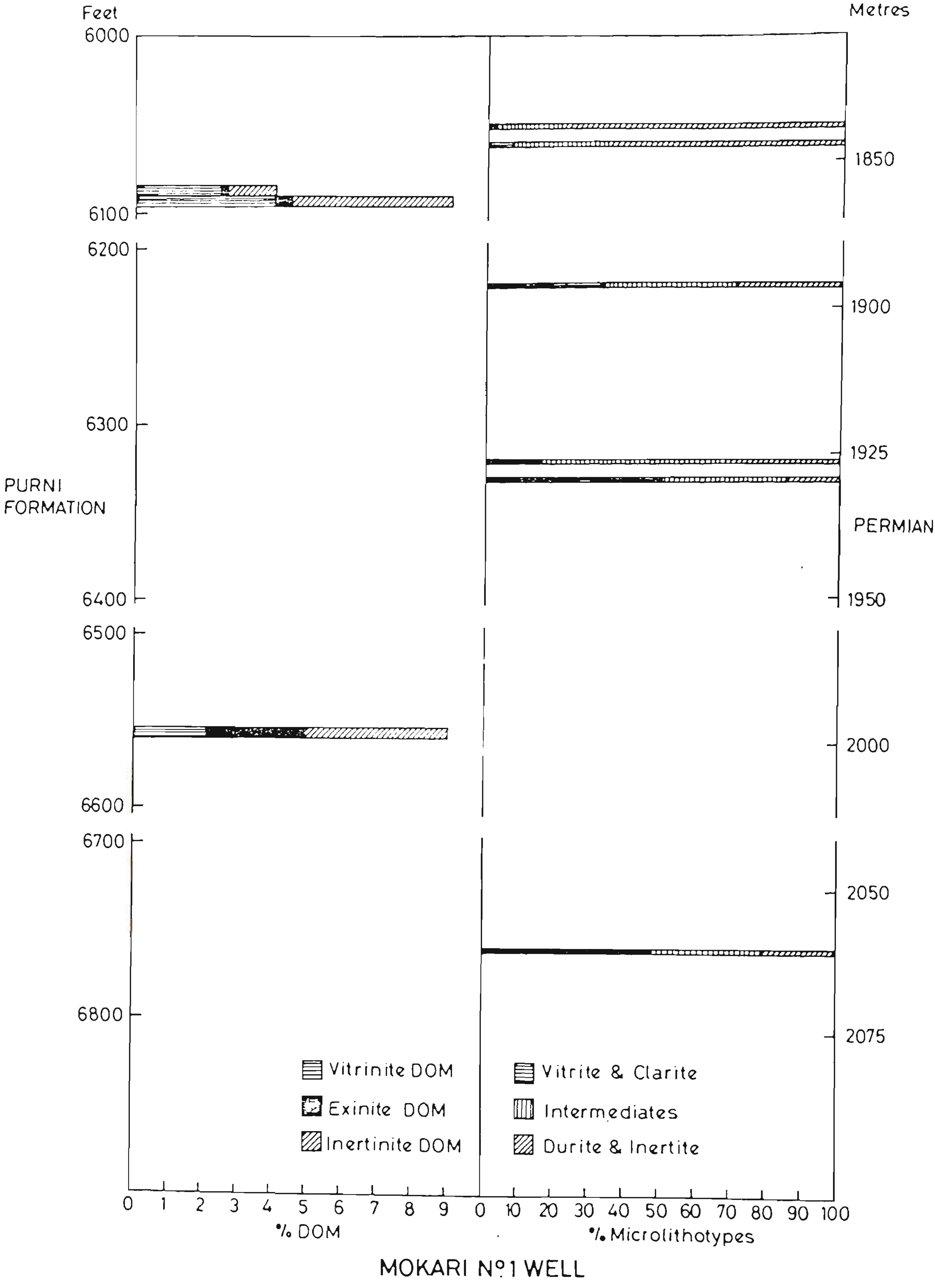


FIG. 6.17 Amount and type of DOM and compositions of associated coals (microlithotypes)

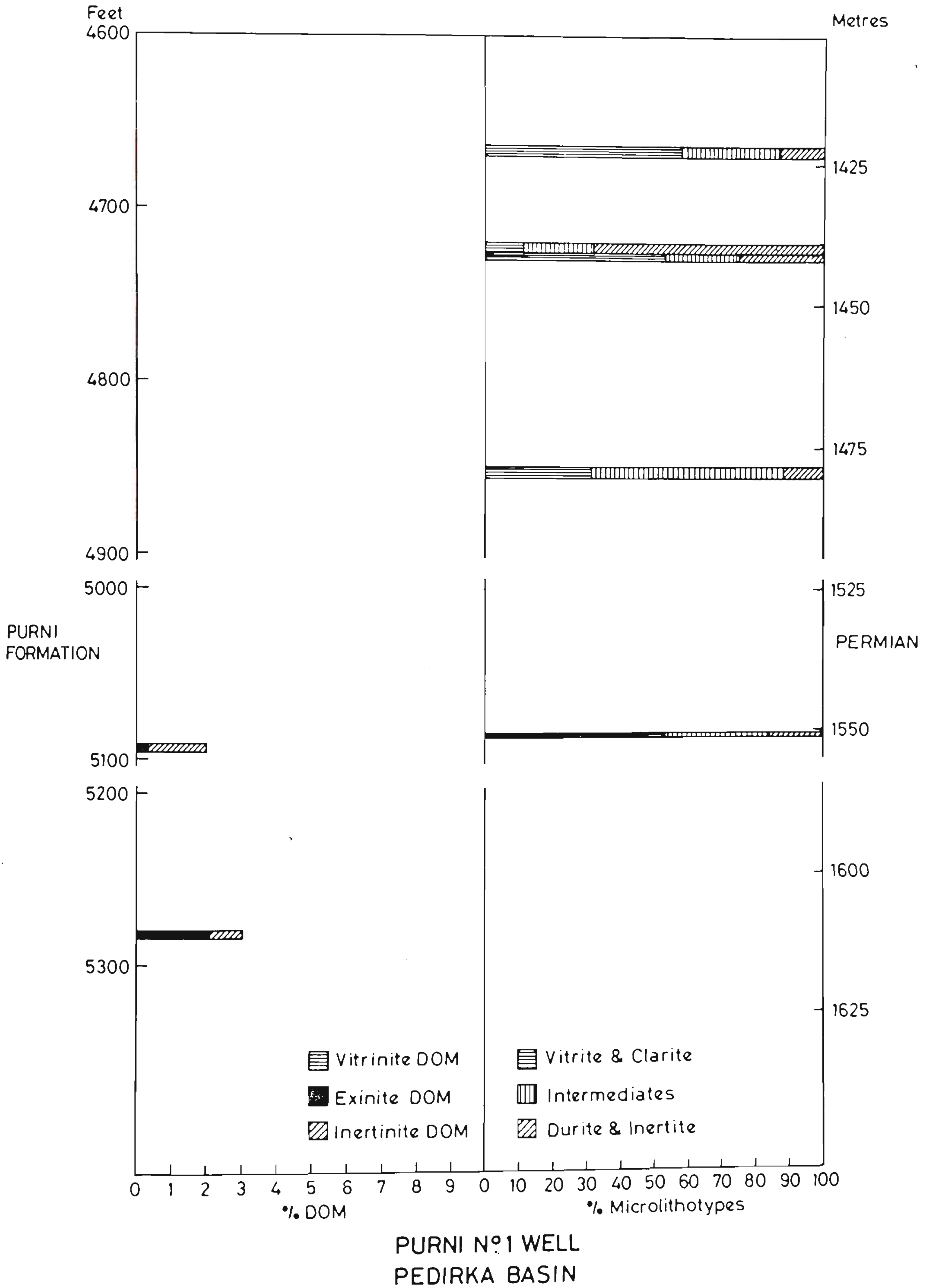


FIG. 6.18 Amount and type of DOM and compositions of associated coals (microlithotypes)

E_D and $\dfrac{E_c}{V_c}$

and in Table 6.20, the <u>negative</u> correlation

$\dfrac{E_D}{V_D}$ and $\dfrac{E_c}{V_c}$

The amount of exinite to vitrinite DOM decreases with an increase in the ratio of exinite to vitrinite in the associated coal.

None of the correlations for the Permian and Triassic organic matter in Macumba 1 and Poolowanna 1 was the same as any found for Tindilpie 1 Permian organic matter. In Tindilpie 1, Permian, $\dfrac{E_D}{V_D}$ correlated positively with $\dfrac{E_c}{V_c}$, the opposite to the above findings for Macumba 1 plus Poolowanna 1 Triassic.

6. (v) <u>Conclusions</u>

Organic matter from four wells in the Pedirka Basin and two in the Simpson Desert Basin has been studied. Only for one well, Macumba 1, was the maceral composition of DOM and associated coal counted on bulk samples, providing results suitable for statistical testing. <u>Negative</u> correlations found for the Permian organic matter from Macumba 1 are:

V_D with $\dfrac{E_c}{I_c}$; and

E_c with $\dfrac{V_D}{I_D}$

High exinite content in the coal is associated with lower vitrinite DOM contents in the associated sediments.

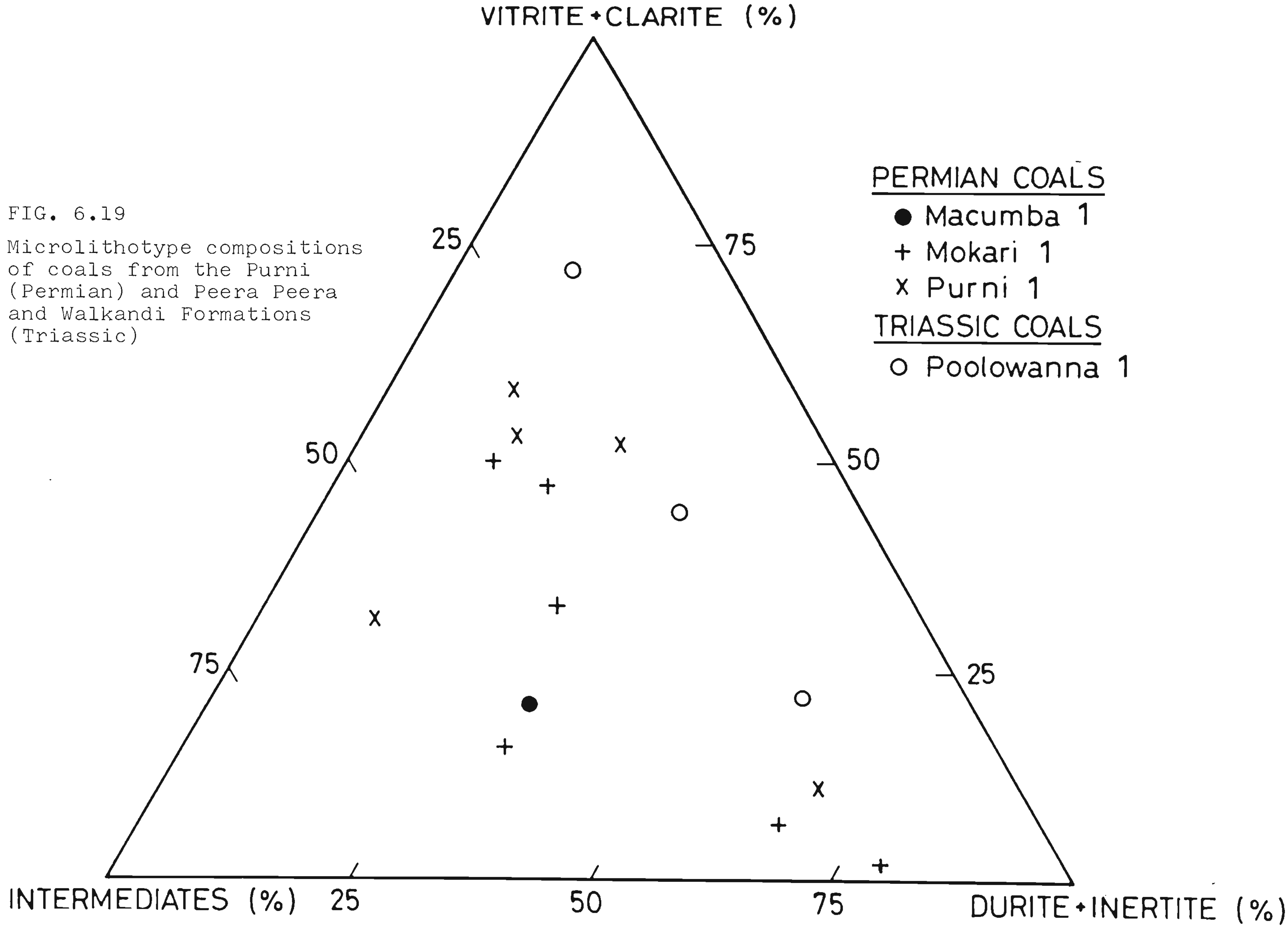
Results from the Triassic sediments at Macumba 1 and Poolowanna 1 when combined, yielded the following <u>negative</u> correlations:

E_D and $\dfrac{E_c}{V_c}$; and

$\dfrac{E_D}{V_D}$ and $\dfrac{E_c}{V_c}$

FIG. 6.19

Microlithotype compositions of coals from the Purni (Permian) and Peera Peera and Walkandi Formations (Triassic)



The more exinite found in the coal, the less exinite DOM in associated sediments; and the ratio of exinite to vitrinite DOM decreases with an increase in the ratio of exinite to vitrinite in the associated coals.

That is, the more exinite found in the coal (Permian and Triassic) the less exinite and/or vitrinite DOM in the associated sediments.

The above correlations are opposite to those found for Permian sequences in Tindilpie 1.

The generality of correlations between DOM and associated coals has therefore not been established for the Cooper, Pedirka and Simpson Desert Basins.

		nobs	tau	sd	z
2	1	16	-0.077	0.190	-0.406
3	1	16	-0.763	0.188	-4.064
3	2	16	-0.182	0.191	-0.954
4	1	16	-0.143	0.187	-0.767
4	2	16	-0.362	0.190	-1.907
4	3	16	0.162	0.188	0.860
5	1	16	0.000	0.189	0.000
5	2	16	0.044	0.192	0.227
5	3	16	-0.086	0.190	-0.453
5	4	16	-0.232	0.190	-1.220
6	1	16	0.067	0.186	0.361
6	2	16	0.240	0.189	1.270
6	3	16	-0.102	0.187	-0.543
6	4	16	-0.329	0.187	-1.761
6	5	16	-0.462	0.189	-2.447
7	1	1			
7	2	1			
7	3	1			
7	4	1			
7	5	1			
7	6	1			
8	1	1			
8	2	1			
8	3	1			
8	4	1			
8	5	1			
8	6	1			
8	7	1			
9	1	1			
9	2	1			
9	3	1			
9	4	1			
9	5	1			
9	6	1			
9	7	1			
9	8	1			

1 = V_C
2 = E_C
3 = I_C

4 = V_D
5 = E_D
6 = I_D

7 = V+C
8 = In
9 = D+I

TABLE 6.9 Correlation of DOM macerals (4,5,6) with coal macerals (1,2,3), Purni Formation, Macumba 1.

		nobs	tau	sd	z	
2 / 1	1	16	-0.437	0.186	-2.346	
2 / 1	2	16	0.661	0.189	3.493	
2 / 1	3	16	0.186	0.187	0.995	
2 / 1	4	16	-0.177	0.187	-0.948	
2 / 1	5	16	-0.017	0.189	-0.091	
2 / 1	6	16	0.101	0.186	0.541	
2 / 1	7	1				
2 / 1	8	1				
2 / 1	9	1				
1 / 3	1	16	0.879	0.186	4.732	
1 / 3	2	16	0.051	0.189	0.272	
1 / 3	3	16	-0.886	0.187	-4.745	
1 / 3	4	16	-0.185	0.186	-0.993	
1 / 3	5	16	0.060	0.188	0.317	
1 / 3	6	16	0.126	0.186	0.676	
1 / 3	7	1				
1 / 3	8	1				
1 / 3	9	1				
2 / 3	1	16	0.226	0.186	1.217	
2 / 3	2	16	0.718	0.189	3.808	
2 / 3	3	16	-0.481	0.187	-2.576	
2 / 3	4	16	-0.387	0.186	-2.075	*
2 / 3	5	16	0.111	0.188	0.589	
2 / 3	6	16	0.209	0.186	1.127	
2 / 3	7	1				
2 / 3	8	1				
2 / 3	9	1				
5 / 4	1	16	0.034	0.188	0.181	
5 / 4	2	16	0.216	0.191	1.136	
5 / 4	3	16	-0.171	0.189	-0.906	
5 / 4	4	16	-0.468	0.188	-2.486	
5 / 4	5	16	0.767	0.190	4.039	
5 / 4	6	16	-0.220	0.188	-1.174	
5 / 4	7	1				
5 / 4	8	1				
5 / 4	9	1				
4 / 6	1	16	-0.176	0.186	-0.946	
4 / 6	2	16	-0.376	0.189	-1.995	*
4 / 6	3	16	0.211	0.187	1.130	
4 / 6	4	16	0.807	0.186	4.331	
4 / 6	5	16	-0.026	0.188	-0.136	
4 / 6	6	16	-0.527	0.186	-2.839	
4 / 6	7	1				
4 / 6	8	1				

TABLE 6.10

* significant correlation

4 / 6	9	1			
5 / 6	1	16	0.000	0.188	0.000
5 / 6	2	16	-0.026	0.191	-0.136
5 / 6	3	16	-0.068	0.189	-0.362
5 / 6	4	16	-0.162	0.188	-0.859
5 / 6	5	16	0.940	0.190	4.946
5 / 6	6	16	-0.525	0.188	-2.800
5 / 6	7	1			
5 / 6	8	1			
5 / 6	9	1			
8 / 7	1	1			
8 / 7	2	1			
8 / 7	3	1			
8 / 7	4	1			
8 / 7	5	1			
8 / 7	6	1			
8 / 7	7	1			
8 / 7	8	1			
8 / 7	9	1			
7 / 9	1	1			
7 / 9	2	1			
7 / 9	3	1			
7 / 9	4	1			
7 / 9	5	1			
7 / 9	6	1			
7 / 9	7	1			
7 / 9	8	1			
7 / 9	9	1			
8 / 9	1	1			
8 / 9	2	1			
8 / 9	3	1			
8 / 9	4	1			
8 / 9	5	1			
8 / 9	6	1			
8 / 9	7	1			
8 / 9	8	1			
8 / 9	9	1			

TABLE 6.10 (continued)

Correlations of ratios of macerals of coals and DOM with macerals of coals and DOM, Purni Formation, Macumba 1.

		nobs	tau	sd	z
1 / 3	2 / 1	16	-0.310	0.186	-1.668
2 / 3	2 / 1	16	0.343	0.186	1.848
2 / 3	1 / 3	16	0.350	0.186	1.883
5 / 4	2 / 1	16	0.119	0.188	0.632
5 / 4	1 / 3	16	0.110	0.187	0.586
5 / 4	2 / 3	16	0.312	0.187	1.669
4 / 6	2 / 1	16	-0.126	0.186	-0.676
4 / 6	1 / 3	16	-0.233	0.186	-1.255
4 / 6	2 / 3	16	-0.350	0.186	-1.883
4 / 6	5 / 4	16	-0.262	0.187	-1.401
5 / 6	2 / 1	16	-0.085	0.188	-0.452
5 / 6	1 / 3	16	0.042	0.187	0.226
5 / 6	2 / 3	16	0.042	0.187	0.226
5 / 6	5 / 4	16	0.692	0.189	3.668
5 / 6	4 / 6	16	0.042	0.187	0.226
8 / 7	2 / 1	1			
8 / 7	1 / 3	1			
8 / 7	2 / 3	1			
8 / 7	5 / 4	1			
8 / 7	4 / 6	1			
8 / 7	5 / 6	1			
7 / 9	2 / 1	1			
7 / 9	1 / 3	1			
7 / 9	2 / 3	1			
7 / 9	5 / 4	1			
7 / 9	4 / 6	1			
7 / 9	5 / 6	1			
7 / 9	8 / 7	1			
8 / 9	2 / 1	1			
8 / 9	1 / 3	1			
8 / 9	2 / 3	1			
8 / 9	5 / 4	1			
8 / 9	4 / 6	1			
8 / 9	5 / 6	1			
8 / 9	8 / 7	1			
8 / 9	7 / 9	1			

TABLE 6.11 Correlations of ratios of macerals of coals and DOM, Purni Formation, Macumba 1.

		nobs	tau	sd	z
2	1	19	-0.162	0.181	-0.895
3	1	19	-0.548	0.170	-3.227
3	2	19	-0.325	0.175	-1.858
4	1	19	0.018	0.171	0.105
4	2	19	0.094	0.176	0.536
4	3	19	-0.229	0.172	-1.335
5	1	19	-0.043	0.175	-0.244
5	2	19	-0.147	0.180	-0.818
5	3	19	0.055	0.176	0.315
5	4	19	-0.074	0.176	-0.420
6	1	19	0.053	0.169	0.316
6	2	19	0.193	0.174	1.107
6	3	19	-0.006	0.170	-0.035
6	4	19	-0.359	0.170	-2.110
6	5	19	-0.598	0.172	-3.472
7	1	0			
7	2	0			
7	3	0			
7	4	0			
7	5	0			
7	6	0			
8	1	0			
8	2	0			
8	3	0			
8	4	0			
8	5	0			
8	6	0			
8	7	0			
9	1	0			
9	2	0			
9	3	0			
9	4	0			
9	5	0			
9	6	0			
9	7	0			
9	8	0			

1 = V_C
2 = E_C
3 = I_C

4 = V_D
5 = E_D
6 = I_D

TABLE 6.12 Correlations between coal macerals (1,2,3) and DOM macerals (4,5,6) from the Triassic Peera Peera Formation, Macumba 1 well.

		nobs	tau	sd	z
2 / 1	1	18	-0.375	0.187	-2.011
2 / 1	2	18	0.806	0.193	4.179
2 / 1	3	18	-0.168	0.188	-0.895
2 / 1	4	18	0.063	0.189	0.336
2 / 1	5	18	-0.252	0.191	-1.319
2 / 1	6	18	0.271	0.187	1.453
2 / 1	7	1			
2 / 1	8	1			
2 / 1	9	1			
1 / 3	1	18	0.715	0.174	4.101
1 / 3	2	18	0.213	0.179	1.192
1 / 3	3	18	-0.787	0.175	-4.487
1 / 3	4	18	0.067	0.176	0.381
1 / 3	5	18	0.074	0.177	0.420
1 / 3	6	18	-0.013	0.174	-0.076
1 / 3	7	1			
1 / 3	8	1			
1 / 3	9	1			
2 / 3	1	18	0.028	0.184	0.150
2 / 3	2	18	0.896	0.188	4.754
2 / 3	3	18	-0.570	0.185	-3.084
2 / 3	4	18	0.153	0.185	0.828
2 / 3	5	18	-0.190	0.186	-1.020
2 / 3	6	18	0.179	0.183	0.976
2 / 3	7	1			
2 / 3	8	1			
2 / 3	9	1			
5 / 4	1	16	0.166	0.195	0.853
5 / 4	2	16	-0.239	0.201	-1.189
5 / 4	3	16	0.053	0.195	0.270
5 / 4	4	16	-0.412	0.195	-2.113
5 / 4	5	16	0.661	0.197	3.350
5 / 4	6	16	-0.262	0.195	-1.348
5 / 4	7	1			
5 / 4	8	1			
5 / 4	9	1			
4 / 6	1	19	-0.042	0.170	-0.246
4 / 6	2	19	0.056	0.175	0.322
4 / 6	3	19	-0.168	0.170	-0.984
4 / 6	4	19	0.898	0.171	5.243
4 / 6	5	19	0.037	0.173	0.213
4 / 6	6	19	-0.464	0.170	-2.737
4 / 6	7	1			
4 / 6	8	1			

TABLE 6.13

4 / 6	9	1			
5 / 6	1	19	-0.061	0.174	-0.350
5 / 6	2	19	-0.153	0.179	-0.855
5 / 6	3	19	0.073	0.175	0.420
5 / 6	4	19	0.006	0.176	0.035
5 / 6	5	19	0.928	0.177	5.229
5 / 6	6	19	-0.675	0.174	-3.882
5 / 6	7	1			
5 / 6	8	1			
5 / 6	9	1			
8 / 7	1	1			
8 / 7	2	1			
8 / 7	3	1			
8 / 7	4	1			
8 / 7	5	1			
8 / 7	6	1			
8 / 7	7	1			
8 / 7	8	1			
8 / 7	9	1			
7 / 9	1	1			
7 / 9	2	1			
7 / 9	3	1			
7 / 9	4	1			
7 / 9	5	1			
7 / 9	6	1			
7 / 9	7	1			
7 / 9	8	1			
7 / 9	9	1			
8 / 9	1	1			
8 / 9	2	1			
8 / 9	3	1			
8 / 9	4	1			
8 / 9	5	1			
8 / 9	6	1			
8 / 9	7	1			
8 / 9	8	1			
8 / 9	9	1			

TABLE 6.13 (continued)

Correlations between ratios of coal and DOM macerals and coal and DOM macerals, Peera Peera Formation, Macumba 1.

		nobs	tau	sd	z
1 / 3	2 / 1	17	0.015	0.185	0.084
2 / 3	2 / 1	17	0.696	0.197	3.541
2 / 3	1 / 3	18	0.331	0.184	1.803
5 / 4	2 / 1	15	-0.305	0.210	-1.455
5 / 4	1 / 3	15	0.168	0.200	0.843
5 / 4	2 / 3	15	-0.299	0.205	-1.459
4 / 6	2 / 1	18	0.035	0.181	0.194
4 / 6	1 / 3	18	0.027	0.175	0.152
4 / 6	2 / 3	18	0.097	0.180	0.540
4 / 6	5 / 4	16	-0.252	0.191	-1.323
5 / 6	2 / 1	18	-0.244	0.186	-1.311
5 / 6	1 / 3	18	0.054	0.177	0.304
5 / 6	2 / 3	18	-0.211	0.182	-1.156
5 / 6	5 / 4	16	0.596	0.195	3.058
5 / 6	4 / 6	19	0.116	0.175	0.665
8 / 7	2 / 1	1			
8 / 7	1 / 3	1			
8 / 7	2 / 3	1			
8 / 7	5 / 4	1			
8 / 7	4 / 6	1			
8 / 7	5 / 6	1			
7 / 9	2 / 1	1			
7 / 9	1 / 3	1			
7 / 9	2 / 3	1			
7 / 9	5 / 4	1			
7 / 9	4 / 6	1			
7 / 9	5 / 6	1			
7 / 9	8 / 7	1			
8 / 9	2 / 1	1			
8 / 9	1 / 3	1			
8 / 9	2 / 3	1			
8 / 9	5 / 4	1			
8 / 9	4 / 6	1			
8 / 9	5 / 6	1			
8 / 9	8 / 7	1			
8 / 9	7 / 9	1			

TABLE 6.14 Correlations of ratios of coal and DOM macerals, Peera Peera Formation, Macumba 1.

		nobs	tau	sd	z
2	1	14	0.183	0.209	0.876
3	1	14	-0.818	0.202	-4.057
3	2	14	-0.375	0.206	-1.825
4	1	14	0.078	0.202	0.384
4	2	14	0.274	0.206	1.329
4	3	14	-0.088	0.202	-0.438
5	1	14	0.057	0.207	0.274
5	2	14	-0.234	0.211	-1.106
5	3	14	-0.023	0.206	-0.109
5	4	14	-0.102	0.207	-0.493
6	1	14	0.000	0.202	0.000
6	2	14	-0.125	0.206	-0.608
6	3	14	0.011	0.201	0.055
6	4	14	-0.663	0.202	-3.290
6	5	14	-0.249	0.205	-1.215
7	1	2			
7	2	2			
7	3	2			
7	4	2			
7	5	2			
7	6	2			
8	1	2			
8	2	2			
8	3	2			
8	4	2			
8	5	2			
8	6	2			
8	7	2			
9	1	2			
9	2	2			
9	3	2			
9	4	2			
9	5	2			
9	6	2			
9	7	2			
9	8	2			

1 = V_C
2 = E_C
3 = I_C

4 = V_D
5 = E_D
6 = I_D

TABLE 6.15 Correlations of coal macerals (1,2,3) with DOM macerals (4,5,6) from the Triassic Peera Peera Formation, Poolowanna 1.

		nobs	tau	sd	z
2 / 1	1	14	-0.191	0.204	-0.934
2 / 1	2	14	0.636	0.209	3.048
2 / 1	3	14	0.000	0.204	0.000
2 / 1	4	14	0.303	0.204	1.484
2 / 1	5	14	-0.356	0.208	-1.716
2 / 1	6	14	-0.134	0.204	-0.658
2 / 1	7	2			
2 / 1	8	2			
2 / 1	9	2			
1 / 3	1	14	0.884	0.202	4.386
1 / 3	2	14	0.307	0.206	1.493
1 / 3	3	14	-0.934	0.201	-4.653
1 / 3	4	14	0.066	0.202	0.329
1 / 3	5	14	0.045	0.205	0.221
1 / 3	6	14	0.011	0.201	0.055
1 / 3	7	2			
1 / 3	8	2			
1 / 3	9	2			
2 / 3	1	14	0.348	0.204	1.703
2 / 3	2	14	0.844	0.209	4.046
2 / 3	3	14	-0.536	0.204	-2.634
2 / 3	4	14	0.124	0.204	0.604
2 / 3	5	14	-0.218	0.208	-1.051
2 / 3	6	14	0.000	0.204	0.000
2 / 3	7	2			
2 / 3	8	2			
2 / 3	9	2			
5 / 4	1	13	0.103	0.210	0.488
5 / 4	2	13	-0.105	0.214	-0.492
5 / 4	3	13	-0.103	0.210	-0.488
5 / 4	4	13	-0.761	0.211	-3.606
5 / 4	5	13	0.405	0.213	1.902
5 / 4	6	13	0.359	0.210	1.708
5 / 4	7	2			
5 / 4	8	2			
5 / 4	9	2			
4 / 6	1	14	0.110	0.202	0.548
4 / 6	2	14	0.193	0.206	0.940
4 / 6	3	14	-0.121	0.201	-0.602
4 / 6	4	14	0.906	0.202	4.496
4 / 6	5	14	0.000	0.205	0.000
4 / 6	6	14	-0.758	0.201	-3.777
4 / 6	7	2			
4 / 6	8	2			
4 / 6	9	2			

TABLE 6.16

5 / 6	1	14	0.133	0.202	0.658
5 / 6	2	14	-0.125	0.206	-0.608
5 / 6	3	14	-0.099	0.201	-0.493
5 / 6	4	14	0.044	0.202	0.219
5 / 6	5	14	0.882	0.205	4.307
5 / 6	6	14	-0.385	0.201	-1.916
5 / 6	7	2			
5 / 6	8	2			
5 / 6	9	2			
8 / 7	1	2			
8 / 7	2	2			
8 / 7	3	2			
8 / 7	4	2			
8 / 7	5	2			
8 / 7	6	2			
8 / 7	7	2			
8 / 7	8	2			
8 / 7	9	2			
7 / 9	1	2			
7 / 9	2	2			
7 / 9	3	2			
7 / 9	4	2			
7 / 9	5	2			
7 / 9	6	2			
7 / 9	7	2			
7 / 9	8	2			
7 / 9	9	2			
8 / 9	1	2			
8 / 9	2	2			
8 / 9	3	2			
8 / 9	4	2			
8 / 9	5	2			
8 / 9	6	2			
8 / 9	7	2			
8 / 9	8	2			
8 / 9	9	2			

TABLE 6.16 (continued)

Correlations of ratios of coal and DOM macerals with coal and DOM macerals, Poolowanna Beds, Poolowanna 1.

		nobs	tau	sd	z
1 / 3	2 / 1	14	-0.067	0.203	-0.330
2 / 3	2 / 1	14	0.455	0.206	2.207
2 / 3	1 / 3	14	0.469	0.204	2.304
5 / 4	2 / 1	13	-0.348	0.211	-1.650
5 / 4	1 / 3	13	0.179	0.210	0.854
5 / 4	2 / 3	13	0.065	0.211	0.306
4 / 6	2 / 1	14	0.246	0.203	1.211
4 / 6	1 / 3	14	0.099	0.201	0.493
4 / 6	2 / 3	14	0.022	0.203	0.110
4 / 6	5 / 4	13	-0.641	0.210	-3.050
5 / 6	2 / 1	14	-0.313	0.203	-1.541
5 / 6	1 / 3	14	0.121	0.201	0.602
5 / 6	2 / 3	14	-0.134	0.203	-0.661
5 / 6	5 / 4	13	0.256	0.210	1.220
5 / 6	4 / 6	14	0.143	0.201	0.712
8 / 7	2 / 1	2			
8 / 7	1 / 3	2			
8 / 7	2 / 3	2			
8 / 7	5 / 4	2			
8 / 7	4 / 6	2			
8 / 7	5 / 6	2			
7 / 9	2 / 1	2			
7 / 9	1 / 3	2			
7 / 9	2 / 3	2			
7 / 9	5 / 4	2			
7 / 9	4 / 6	2			
7 / 9	5 / 6	2			
7 / 9	8 / 7	2			
8 / 9	2 / 1	2			
8 / 9	1 / 3	2			
8 / 9	2 / 3	2			
8 / 9	5 / 4	2			
8 / 9	4 / 6	2			
8 / 9	5 / 6	2			
8 / 9	8 / 7	2			
8 / 9	7 / 9	2			

TABLE 6.17

Correlations of ratios of coal and DOM macerals, Poolowanna Beds, Poolowanna 1.

		nobs	tau	sd	z
2	1	21	0.029	0.162	0.181
3	1	21	-0.654	0.159	-4.114
3	2	21	-0.392	0.161	-2.432
4	1	21	-0.140	0.159	-0.877
4	2	21	0.260	0.162	1.611
4	3	21	-0.082	0.159	-0.514
5	1	21	0.064	0.163	0.393
5	2	21	-0.276	0.165	-1.671
5	3	21	-0.005	0.163	-0.030
5	4	21	-0.089	0.163	-0.544
6	1	21	0.101	0.159	0.635
6	2	21	0.034	0.162	0.213
6	3	21	0.034	0.159	0.212
6	4	21	-0.454	0.160	-2.845
6	5	21	-0.483	0.162	-2.980
7	1	21	0.144	1.229	0.117
7	2	21	0.091	1.253	0.072
7	3	21	-0.233	1.229	-0.190
7	4	21	-0.211	1.232	-0.172
7	5	21	0.068	1.256	0.054
7	6	21	0.100	1.232	0.081
8	1	21	0.144	1.229	0.117
8	2	21	0.091	1.253	0.072
8	3	21	-0.233	1.229	-0.190
8	4	21	-0.211	1.232	-0.172
8	5	21	0.068	1.256	0.054
8	6	21	0.100	1.232	0.081
8	7	21	1.000	2.798	0.357
9	1	21	0.122	1.229	0.099
9	2	21	0.113	1.253	0.090
9	3	21	-0.211	1.229	-0.172
9	4	21	-0.189	1.232	-0.154
9	5	21	0.045	1.256	0.036
9	6	21	0.122	1.232	0.099
9	7	21	0.949	2.798	0.339
9	8	21	0.949	2.798	0.339

TABLE 6.18 Correlations of coal macerals (1,2,3) with DOM macerals (4,5,6), Peera Peera Formation, Macumba 1 and Poolowanna 1, combined.

		nobs	tau	sd	z	
2 / 1	1	21	-0.184	0.160	-1.151	
2 / 1	2	21	0.792	0.163	4.869	
2 / 1	3	21	-0.175	0.160	-1.090	
2 / 1	4	21	0.307	0.161	1.909	
2 / 1	5	21	-0.333	0.163	-2.039	*
2 / 1	6	21	0.034	0.161	0.212	
2 / 1	7	21	-0.011	0.187	-0.060	
2 / 1	8	21	-0.011	0.187	-0.060	
2 / 1	9	21	0.011	0.187	0.060	
1 / 3	1	21	0.853	0.159	5.356	
1 / 3	2	21	0.192	0.162	1.186	
1 / 3	3	21	-0.814	0.159	-5.114	
1 / 3	4	21	-0.077	0.160	-0.484	
1 / 3	5	21	0.010	0.162	0.061	
1 / 3	6	21	0.101	0.160	0.636	
1 / 3	7	21	0.145	0.185	0.780	
1 / 3	8	21	0.145	0.185	0.780	
1 / 3	9	21	0.122	0.185	0.660	
2 / 3	1	21	0.190	0.161	1.181	
2 / 3	2	21	0.849	0.163	5.203	
2 / 3	3	21	-0.550	0.161	-3.421	
2 / 3	4	21	0.146	0.161	0.909	
2 / 3	5	21	-0.199	0.163	-1.217	
2 / 3	6	21	0.059	0.161	0.364	
2 / 3	7	21	0.169	0.187	0.900	
2 / 3	8	21	0.169	0.187	0.900	
2 / 3	9	21	0.146	0.187	0.780	
5 / 4	1	20	0.187	0.164	1.138	
5 / 4	2	20	-0.276	0.166	-1.664	
5 / 4	3	20	-0.043	0.164	-0.260	
5 / 4	4	20	-0.563	0.165	-3.417	
5 / 4	5	20	0.556	0.167	3.333	
5 / 4	6	20	-0.043	0.164	-0.260	
5 / 4	7	20	0.157	0.191	0.821	
5 / 4	8	20	0.157	0.191	0.821	
5 / 4	9	20	0.133	0.191	0.695	
4 / 6	1	21	-0.163	0.158	-1.028	
4 / 6	2	21	0.195	0.161	1.215	
4 / 6	3	21	-0.057	0.158	-0.363	
4 / 6	4	21	0.926	0.159	5.836	
4 / 6	5	21	-0.005	0.161	-0.030	
4 / 6	6	21	-0.532	0.159	-3.356	
4 / 6	7	21	-0.166	0.185	-0.897	
4 / 6	8	21	-0.166	0.185	-0.897	
4 / 6	9	21	-0.144	0.185	-0.777	

TABLE 6.19

* significant correlation

5 / 6	1	21	0.062	0.159	0.393
5 / 6	2	21	-0.182	0.162	-1.125
5 / 6	3	21	-0.082	0.159	-0.514
5 / 6	4	21	0.039	0.160	0.242
5 / 6	5	21	0.892	0.162	5.505
5 / 6	6	21	-0.599	0.160	-3.754
5 / 6	7	21	0.056	0.185	0.300
5 / 6	8	21	0.056	0.185	0.300
5 / 6	9	21	0.033	0.185	0.180
8 / 7	1	21	0.122	1.229	0.099
8 / 7	2	21	0.113	1.253	0.090
8 / 7	3	21	-0.211	1.229	-0.172
8 / 7	4	21	-0.189	1.232	-0.154
8 / 7	5	21	0.045	1.256	0.036
8 / 7	6	21	0.122	1.232	0.099
8 / 7	7	21	0.949	2.798	0.339
8 / 7	8	21	0.949	2.798	0.339
8 / 7	9	21	1.000	2.798	0.357
7 / 9	1	21	0.122	1.229	0.099
7 / 9	2	21	-0.068	1.253	-0.054
7 / 9	3	21	-0.078	1.229	-0.063
7 / 9	4	21	-0.100	1.232	-0.081
7 / 9	5	21	0.341	1.256	0.271
7 / 9	6	21	-0.056	1.232	-0.045
7 / 9	7	21	0.026	2.798	0.009
7 / 9	8	21	0.026	2.798	0.009
7 / 9	9	21	-0.026	2.798	-0.009
8 / 9	1	21	0.144	1.229	0.117
8 / 9	2	21	0.091	1.253	0.072
8 / 9	3	21	-0.233	1.229	-0.190
8 / 9	4	21	-0.211	1.232	-0.172
8 / 9	5	21	0.068	1.256	0.054
8 / 9	6	21	0.100	1.232	0.081
8 / 9	7	21	1.000	2.798	0.357
8 / 9	8	21	1.000	2.798	0.357
8 / 9	9	21	0.949	2.798	0.339

TABLE 6.19 (continued)

Correlations of coal and DOM macerals with ratios of coal and DOM macerals, Peera Peera Formation, Macumba 1 and Poolowanna 1, combined.

		nobs	tau	sd	z	
1 / 3	2 / 1	21	-0.024	0.160	-0.152	
2 / 3	2 / 1	21	0.624	0.162	3.857	
2 / 3	1 / 3	21	0.351	0.161	2.182	
5 / 4	2 / 1	20	-0.381	0.165	-2.312	*
5 / 4	1 / 3	20	0.177	0.165	1.074	
5 / 4	2 / 3	20	-0.118	0.165	-0.717	
4 / 6	2 / 1	21	0.251	0.159	1.576	
4 / 6	1 / 3	21	-0.101	0.159	-0.635	
4 / 6	2 / 3	21	0.073	0.160	0.455	
4 / 6	5 / 4	20	-0.468	0.164	-2.862	
5 / 6	2 / 1	21	-0.268	0.160	-1.670	
5 / 6	1 / 3	21	0.029	0.160	0.182	
5 / 6	2 / 3	21	-0.117	0.161	-0.729	
5 / 6	5 / 4	20	0.429	0.165	2.606	
5 / 6	4 / 6	21	0.120	0.159	0.756	
8 / 7	2 / 1	21	0.011	1.241	0.009	
8 / 7	1 / 3	21	0.122	1.232	0.099	
8 / 7	2 / 3	21	0.146	1.244	0.117	
8 / 7	5 / 4	20	0.133	1.226	0.108	
8 / 7	4 / 6	21	-0.144	1.223	-0.117	
8 / 7	5 / 6	21	0.033	1.232	0.027	
7 / 9	2 / 1	21	-0.168	1.241	-0.136	
7 / 9	1 / 3	21	0.122	1.232	0.099	
7 / 9	2 / 3	21	0.011	1.244	0.009	
7 / 9	5 / 4	20	0.253	1.226	0.206	
7 / 9	4 / 6	21	-0.099	1.223	-0.081	
7 / 9	5 / 6	21	0.345	1.232	0.280	
7 / 9	8 / 7	21	-0.026	2.798	-0.009	
8 / 9	2 / 1	21	-0.011	1.241	-0.009	
8 / 9	1 / 3	21	0.145	1.232	0.117	
8 / 9	2 / 3	21	0.169	1.244	0.136	
8 / 9	5 / 4	20	0.157	1.226	0.128	
8 / 9	4 / 6	21	-0.166	1.223	-0.136	
8 / 9	5 / 6	21	0.056	1.232	0.045	
8 / 9	8 / 7	21	0.949	2.798	0.339	
8 / 9	7 / 9	21	0.026	2.798	0.009	

TABLE 6.20

Correlations of ratios of coal and DOM macerals, Peera Peera Formation, Macumba 1 and Poolowanna 1, combined.

* significant correlation

7. THE PETROLOGY OF COALS AND DISPERSED ORGANIC MATTER FROM THE EROMANGA BASIN

7(i) Introduction

The Jurassic and Cretaceous sediments in Poolowanna 1 and Macumba 1 (Fig. 7.1) form part of the Eromanga Basin.

Vertical rank gradients in the Eromanga Basin where it overlies the Cooper Basin (Fig.1.1) were found by Kantsler et al., (1978) to range between 0.09% $\bar{R}_o$ max/km to 0.23% $\bar{R}_o$ max/km and up to 0.78%/km (Cook, pers. comm., 1984). Geothermal gradients calculated from bottom hole temperature measurements are high (Smyth and Saxby, 1981; Pitt, 1982; Kantsler et al., 1983).

Kantsler et al. (1983) find significant evidence of a Late Palaeozoic to Early Mesozoic phase of rapid early coalification and a Mid to Late Mesozoic and Cainozoic phase of slower coalification. Finally there is a late (possibly Pliocene) change of geothermal gradient variation to the pattern observed at present. The Eromanga Basin section overlying the Pedirka Basin has probably entered the zone of oil generation relatively recently.

Fig.7.2 shows the stratigraphic sequences for Poolowanna 1 and Macumba 1.

7(ii) Organic petrology

Cuttings and cores from Poolowanna 1 and Macumba 1 were selected from the Jurassic Poolowanna and Algebuckina Formations and the Cretaceous Ooodnadatta, Bulldog and Winton Formations for petrographic analyses. The cuttings were froth floated or hand-picked to concentrate the organic matter, except for some of the Macumba 1 samples, where the bulk samples were used.

7(iii) Comparison of organic matter from the Cooper and Eromanga Basins.

The type of organic matter in the Jurassic and Cretaceous sedimentary rocks of the Eromanga Basin is quite different from that of the Permian and Triassic Cooper Basin. In the Eromanga Basin, both the DOM and coals have a high content of vitrinite and/or exinite, with inertinite abundant only locally as DOM, and virtually confined to the Lower Jurassic as far as the coals are concerned (Cook, 1982(b)).

Cook (1981) believes that these marked variations in the petrographic compositions of organic matter through time are, in part, due to a systematic response to evolving floras and changing climate. Within a restricted period of time, petrographic compositions vary with tectonic-sedimentary setting. The differences between the Cooper and Eromanga Basins organic matter types are due to the floral and climatic changes which occurred from the Permian to the Cretaceous. Widespread glaciation of the Early Permian gave way to cool temperate climates in the Late Permian to Late Triassic. The Early Jurassic had a warm temperate climate which became cool temperate in the Cretaceous (Gould and Shibaoka, 1980).

The Glossopteris flora dominated in the Permian coal-forming sequences, and contains relatively few kinds of plants. The Triassic Dicroidium flora was more diverse, and the plants of both these floras were quite distinct from Permian and Triassic floras in the Northern Hemisphere. Jurassic and Early Cretaceous floras in Australia were generally similar to contemporary floras of the northern hemisphere. They include ferns, pteridosperms, cycads and conifers. Conifers are major contributors to the Jurassic and Cretaceous coals.

Plates 7.1 illustrates typical organic matter from the Eromanga Basin.

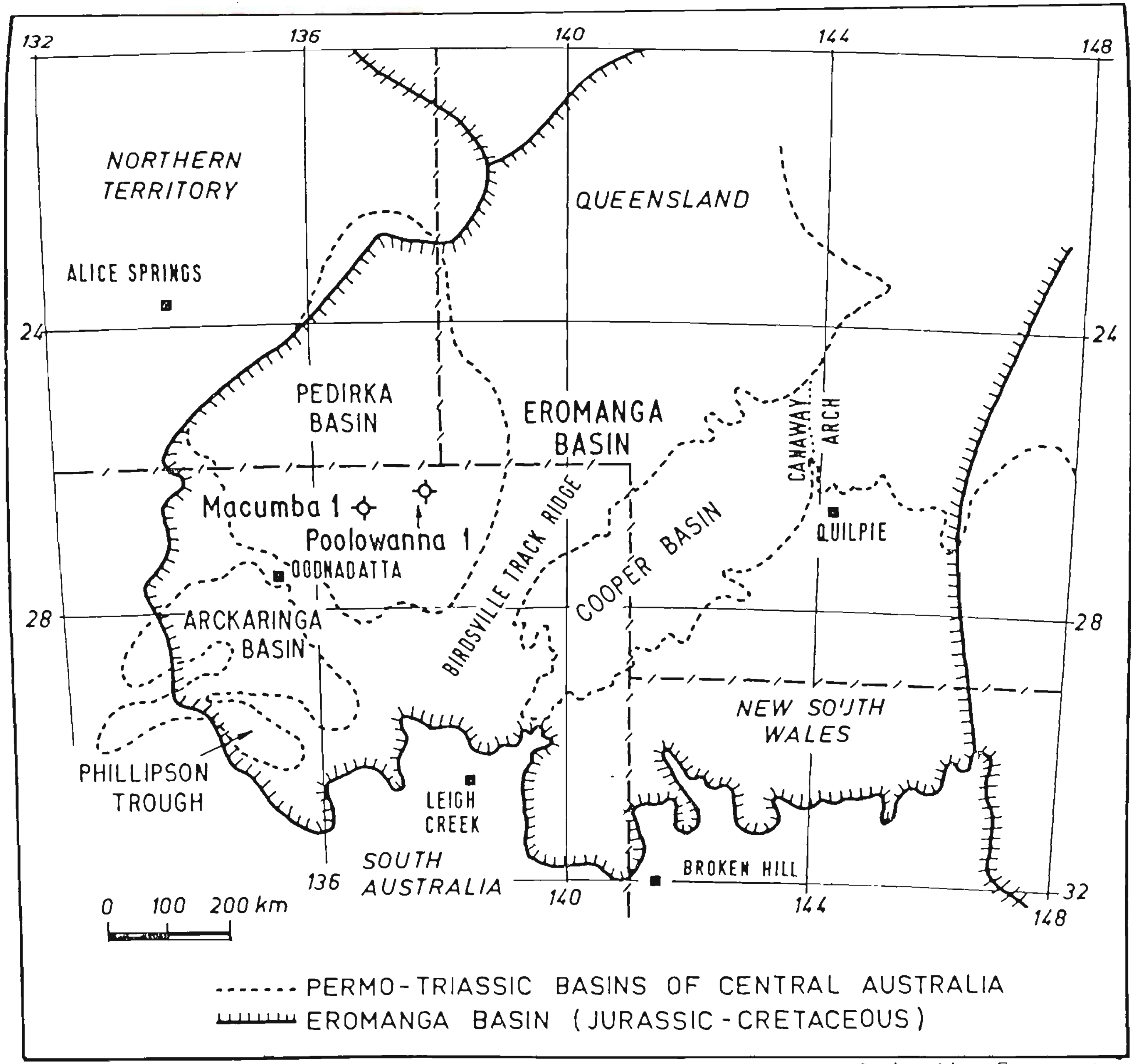


FIG.7.1 Location of Macumbal and Poolowanna 1 in the Eromanga Basin

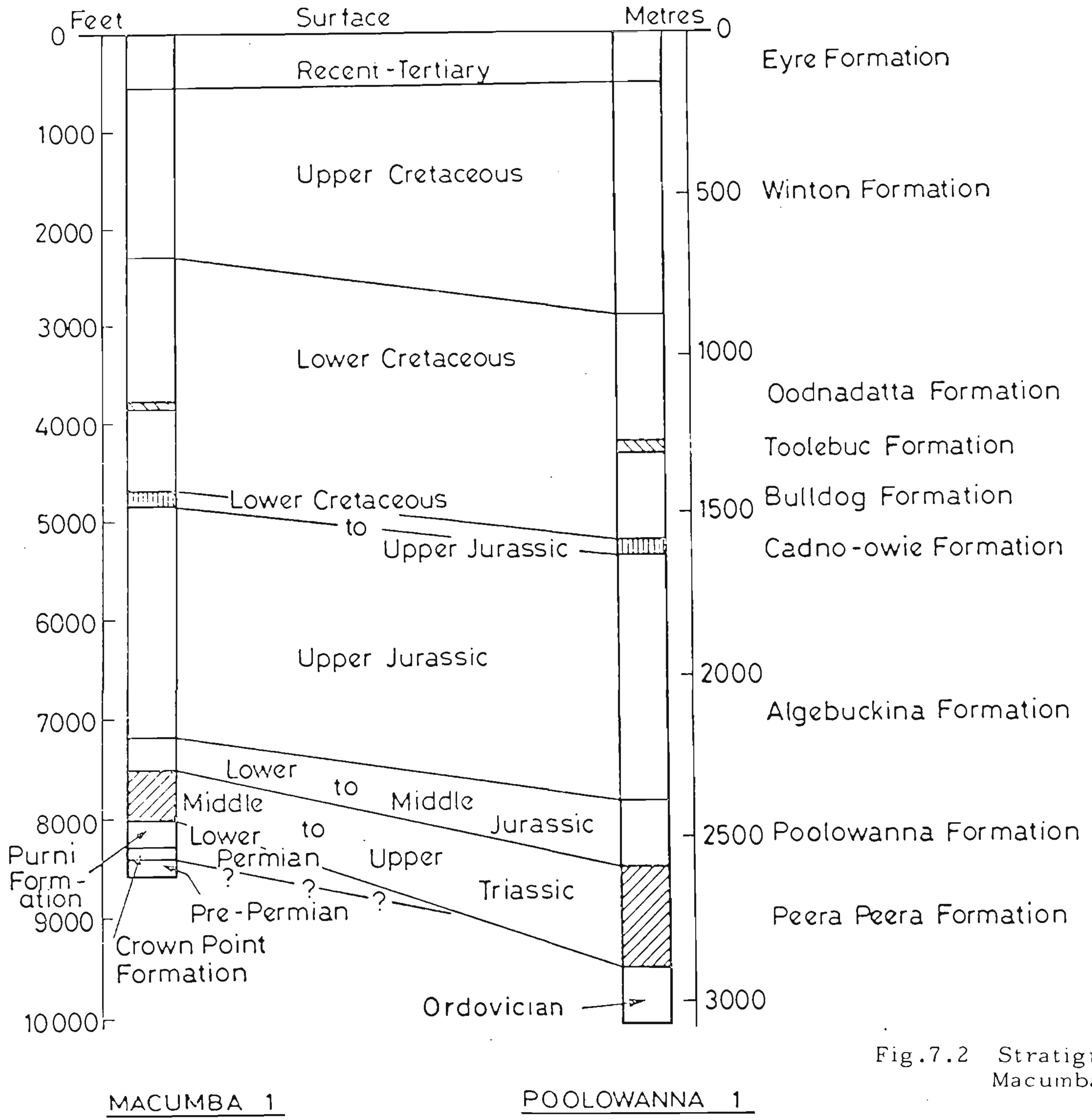


Fig.7.2 Stratigraphy in the Wells Macumba 1 and Poolowanna 1

7(iv) Results of petrographic analyses

The results of maceral analyses on the Poolowanna Formation are in Tables 7.1 and 7.2 (in Appendix) for Macumba 1 and Poolowanna 1, respectively. They are presented diagramatically in Figure 7.3.

The coals have 17-87% vitrinite, 0-33% exinite, and 8-71% intertinite. The DOM has 8-75% vitrinite 0-41% exinite and 18-100% inertinite.

The Algebuckina Formation results are in Tables 7.3 and 7.4, and Figure 7.4. The coals have 46-100% vitrinite, 0-36% exinite and 0-33% inertinite. The DOM falls into two distinct groups, one with very high vitrinite 77-100%, the other with low vitrinite 4-31%, 8-74% exinite and 13-77% inertinite. The high vitrinite DOM is hand-picked material from Poolowanna 1, so the low vitrinite Macumba 1 bulk samples are probably more representative of the DOM in the Algebuckina Formation.

Results of analyses on the coals and DOM in the Oodnadatta, Bulldog, (Lower Cretaceous) and Winton (Upper Cretaceous)Formations are in Tables 7.5, 7.6 and 7.7, and in Figure 7.5.

The coals have 52-100% vitrinite contents, 0-39% exinite and 0-29% inertinite. The DOM is very variable, with vitrinite, 11-66%, exinite 8-55% and inertinite, 16-81%.

The components of the exinite maceral group for the 5 formations are plotted in Figures 7.6 to 7.8. In the Poolowanna Formation (Figure 7.6) almost every combination of sporinite, cutinite and resinite is represented in both coals and DOM. Most of the high (> 50%) resinite samples are coals. Cutinite is the least abundant exinite and alginite is present in some intervals.

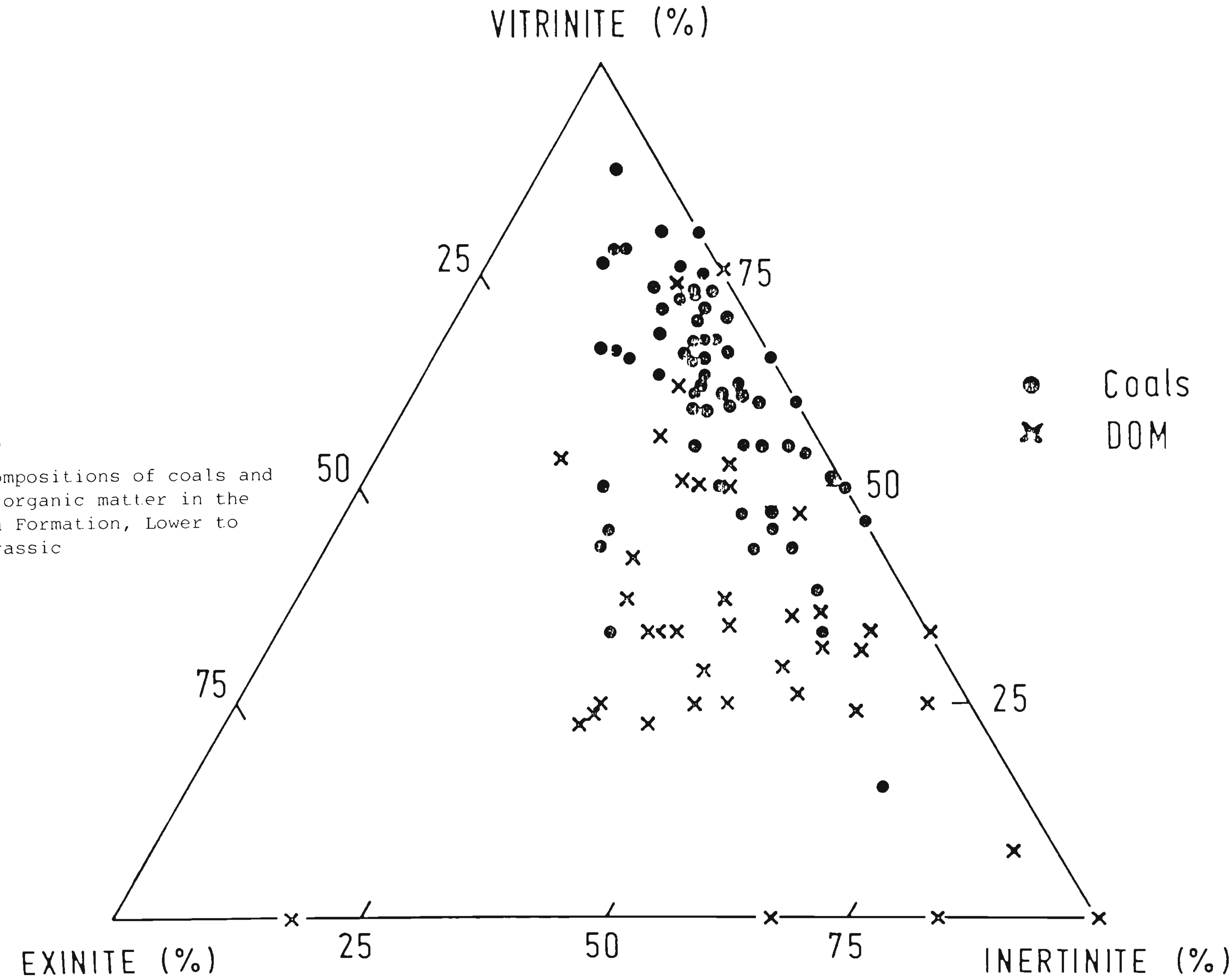


FIGURE 7.3

Maceral compositions of coals and dispersed organic matter in the Poolowanna Formation, Lower to Middle Jurassic

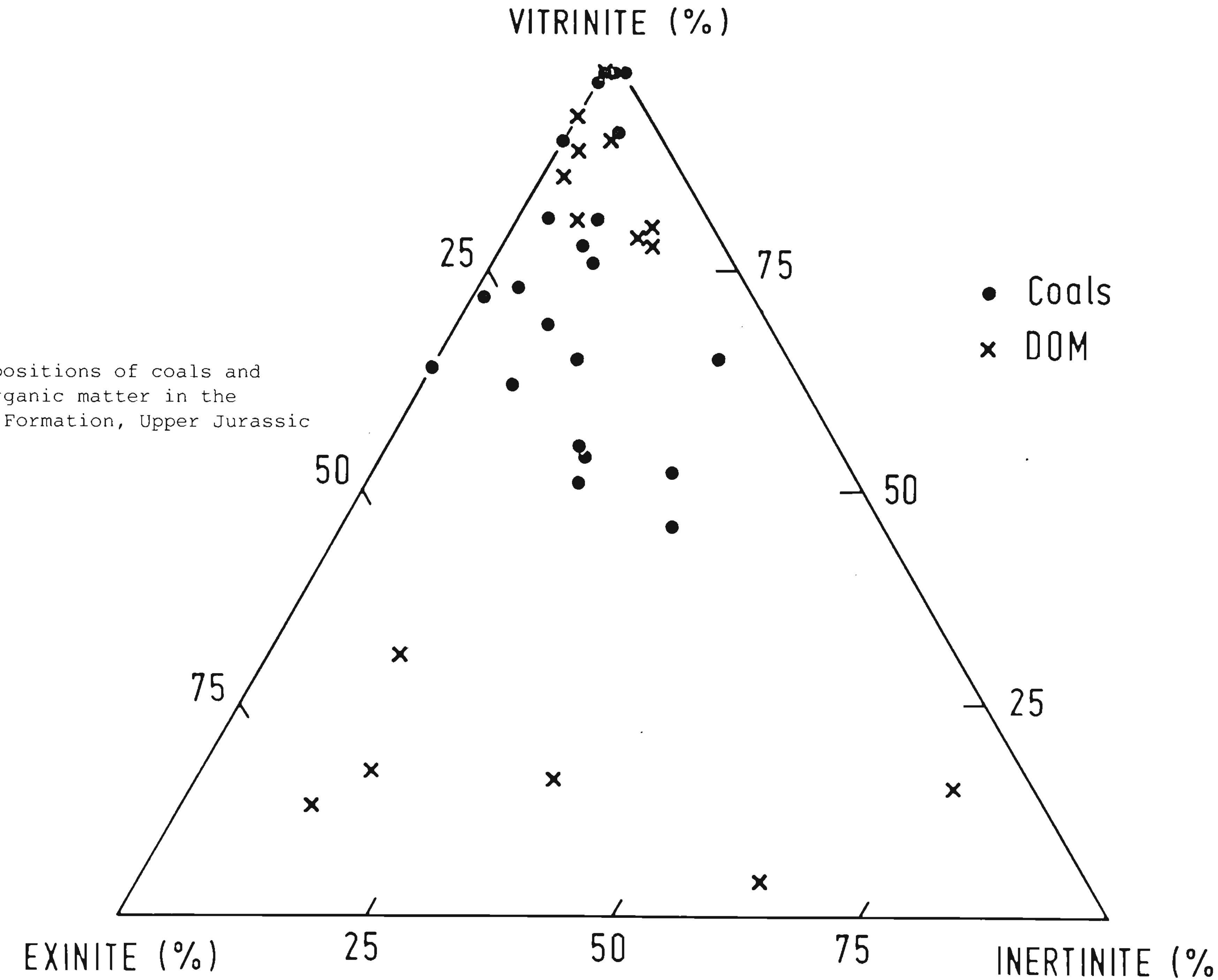


FIGURE 7.4

Maceral compositions of coals and dispersed organic matter in the Algebuckina Formation, Upper Jurassic

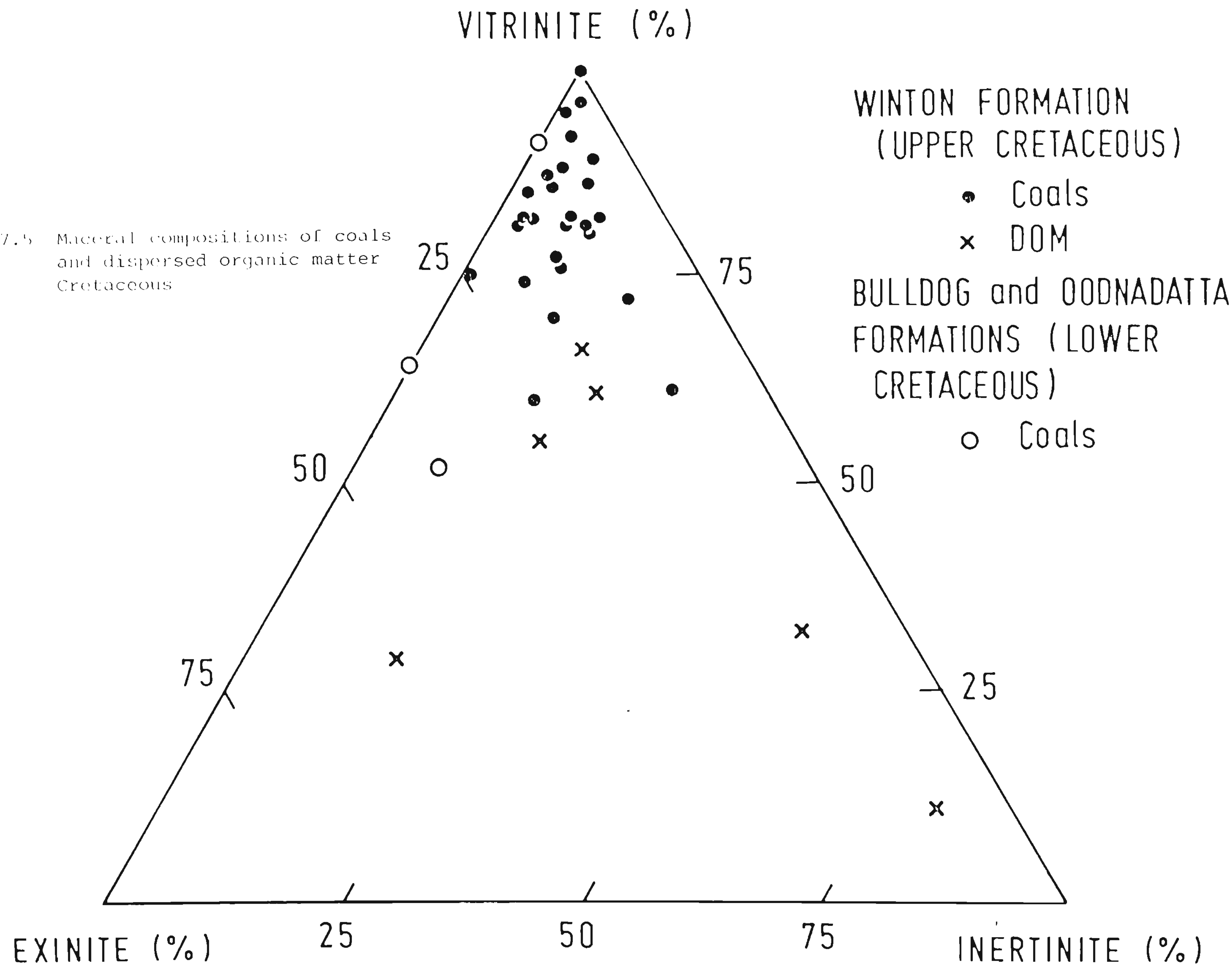


FIG. 7.5 Maceral compositions of coals and dispersed organic matter Cretaceous

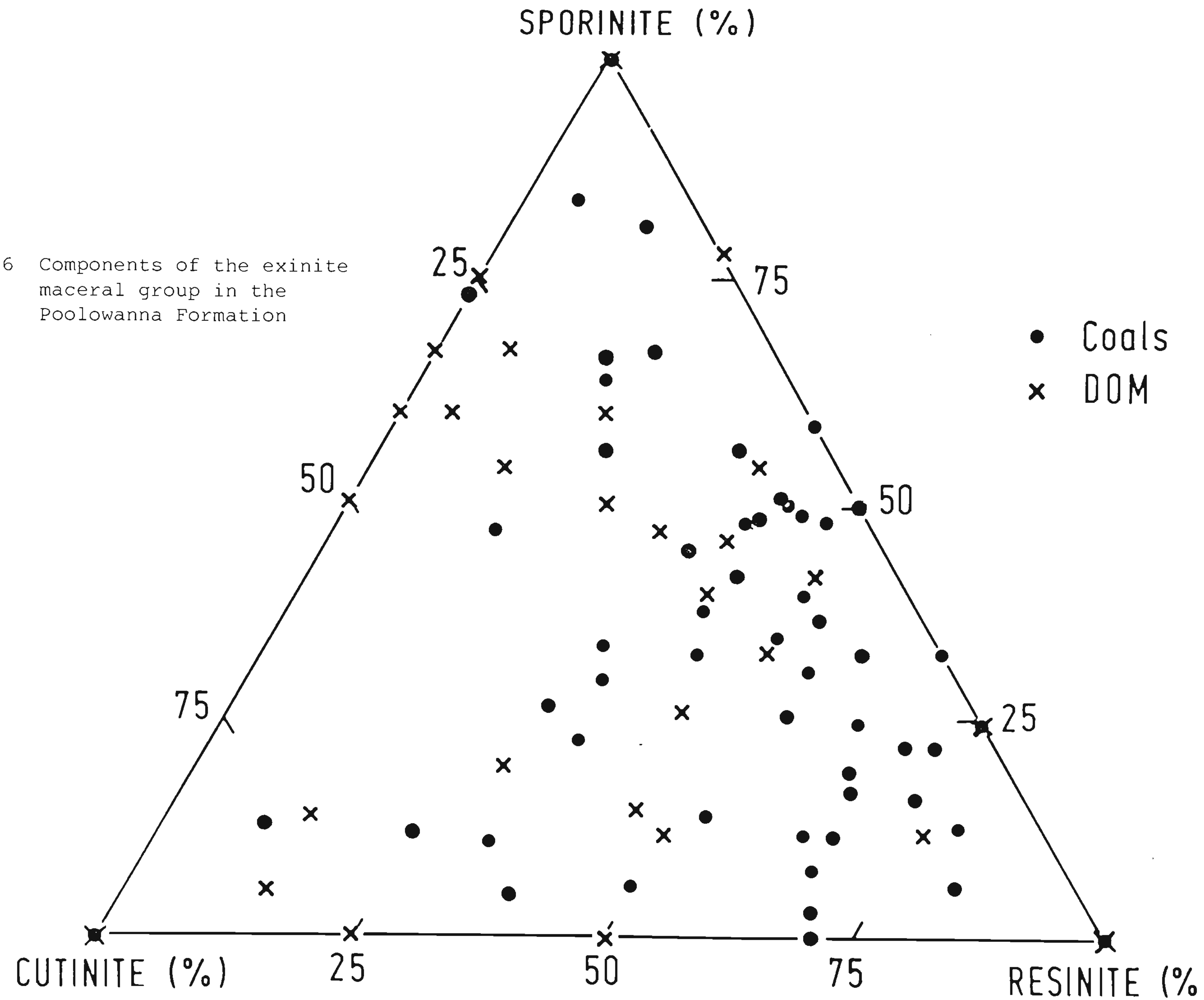


FIG. 7.6 Components of the exinite maceral group in the Poolowanna Formation

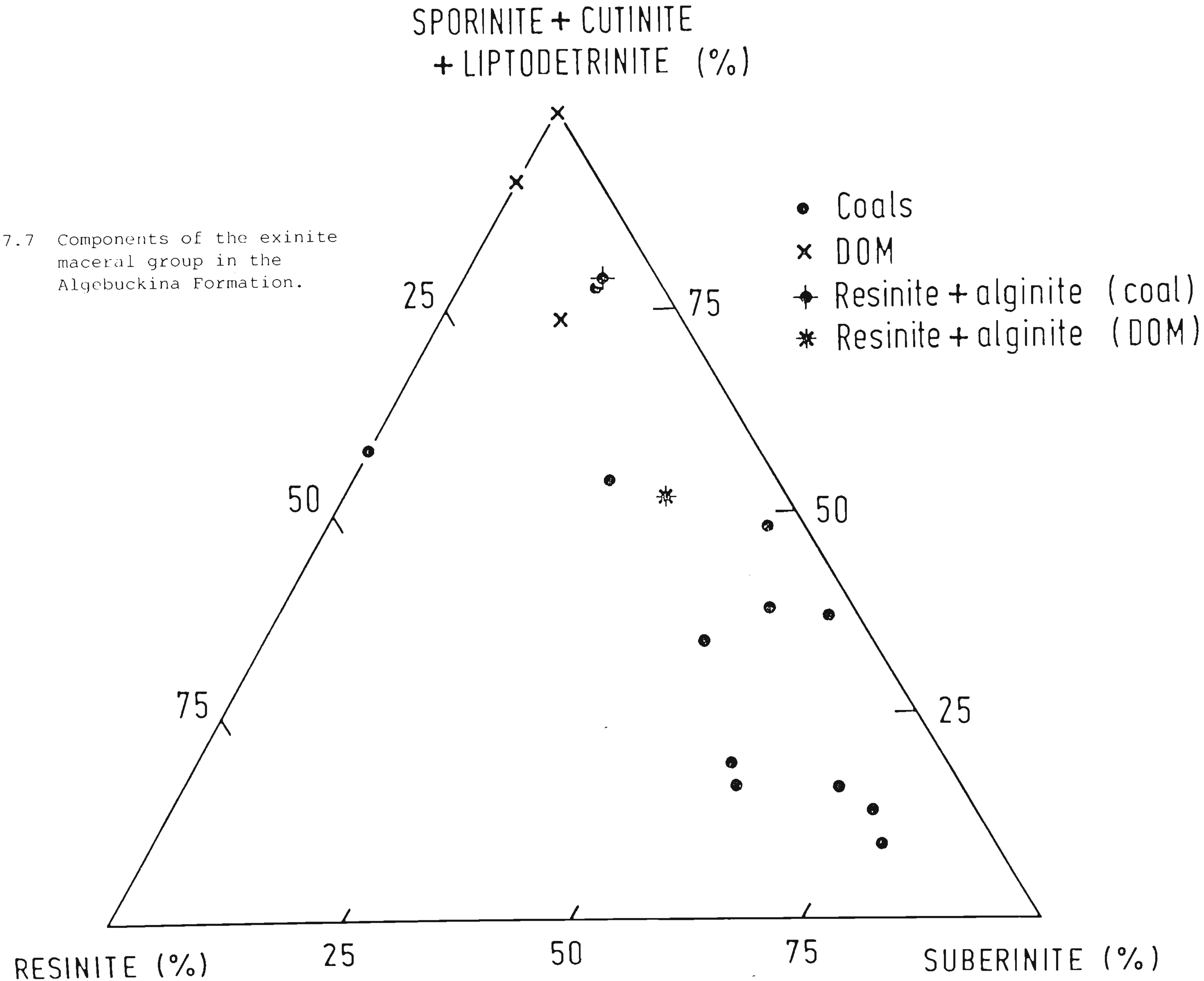


FIG. 7.7 Components of the exinite maceral group in the Algebuckina Formation.

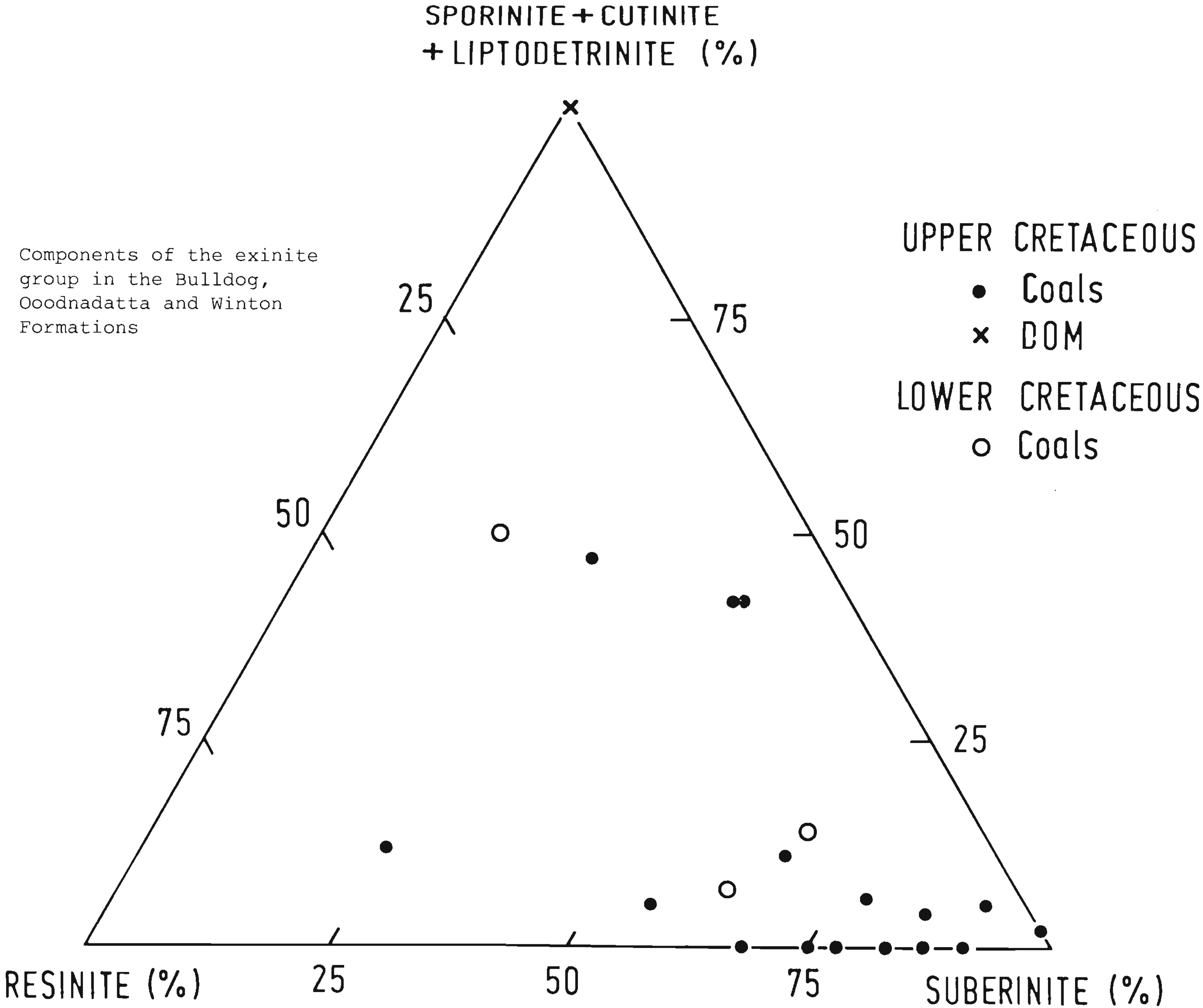


FIG. 7.8 Components of the exinite group in the Bulldog, Ooodnadatta and Winton Formations

The Upper Jurassic Algebuckina Formation coals and the Cretaceous coals contain relatively little sporinite and cutinite compared with the exinite maceral suberinite (Plate 7.1). Suberinite is typical of younger coals, particularly Tertiary brown coals. Its abundance is probably associated with the development of new flora (Cook, 1982(b)). To accommodate this change in exinite types, the apices of the triangles in Figures 7.7 and 7.8 have been changed. Sporinite, cutinite and liptodetrinite (broken pieces of sporinite and cutinite) have been grouped together, and are plotted against resinite and suberinite.

In the Algebuckina Formation (Figure 7.7), suberinite is the dominant exinite in the coals, whilst sporinite plus cutinite are dominant in the DOM. The Cretaceous coals and DOM show a similar distribution (Figure 7.8).

The components of the inertinite maceral group are plotted in Figures 7.9 to 7.11. In the Poolowanna Formation (Figure 7.9), both semi-fusinite and inertodetrinite are well represented, with a tendency for semifusinite to be dominant in the coals, inertodetrinite in the DOM.

Both coals and DOM in the Algebuckina Formations have either high semifusinite or inertodetrinite, with no distinct trend (Figure 7.10).

In the Cretaceous samples both coals and DOM contain more semifusinite than inertodetrinite and an unusually high proportion of fusinite, 0-45%, (Figure 7.11).

The microlithotype compositions of the coals are given in Tables 7.8 to 7.14 and are plotted in Figure 7.12. The Poolowanna Formation coals have 33-84% vitrite plus clarite contents and 1-40% intermediates (duroclarite, clarodurite, vitrinertite). Their durite plus inertite content is 4-54%.

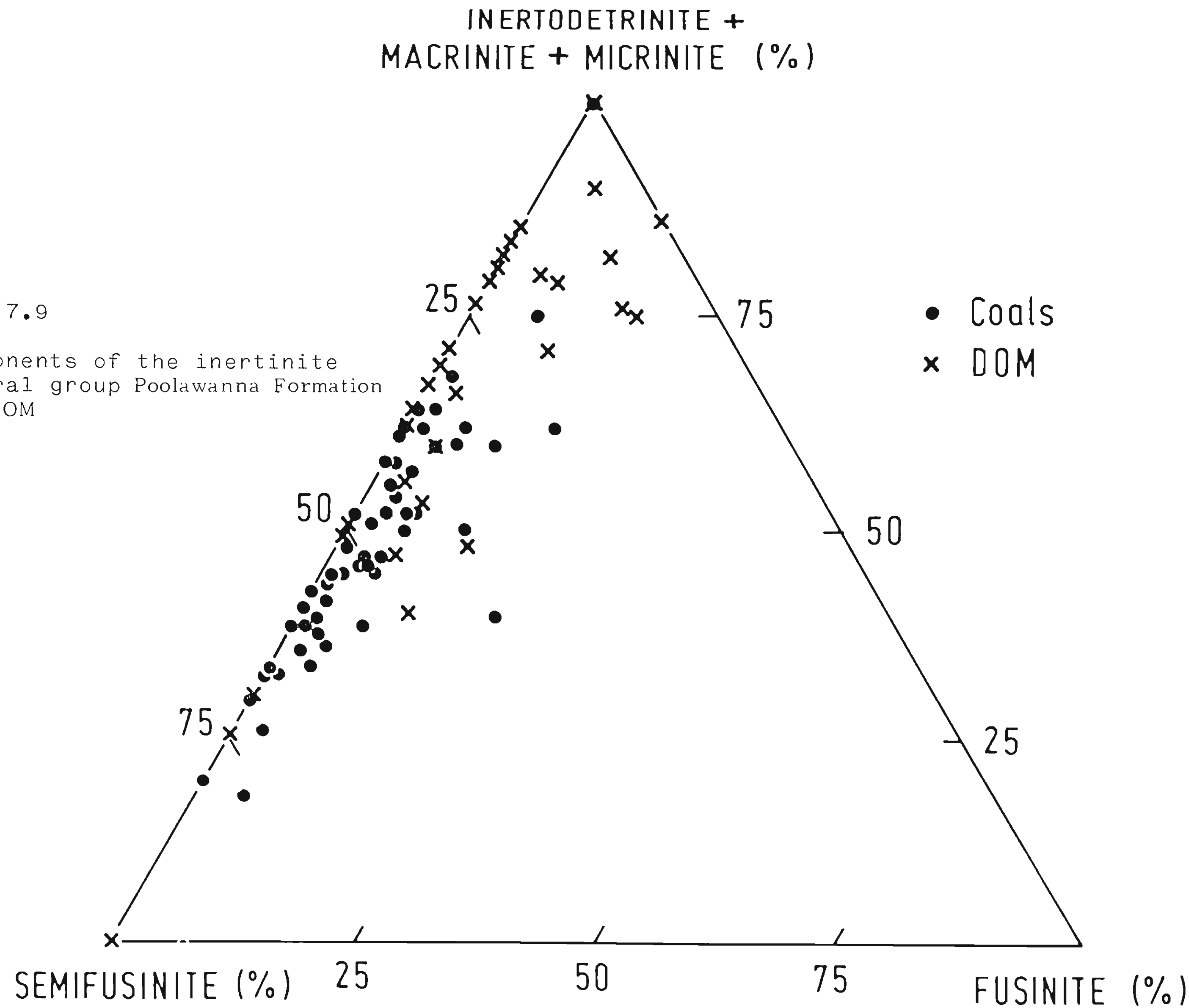


FIG. 7.9

Components of the inertinite maceral group Poolawanna Formation and DOM

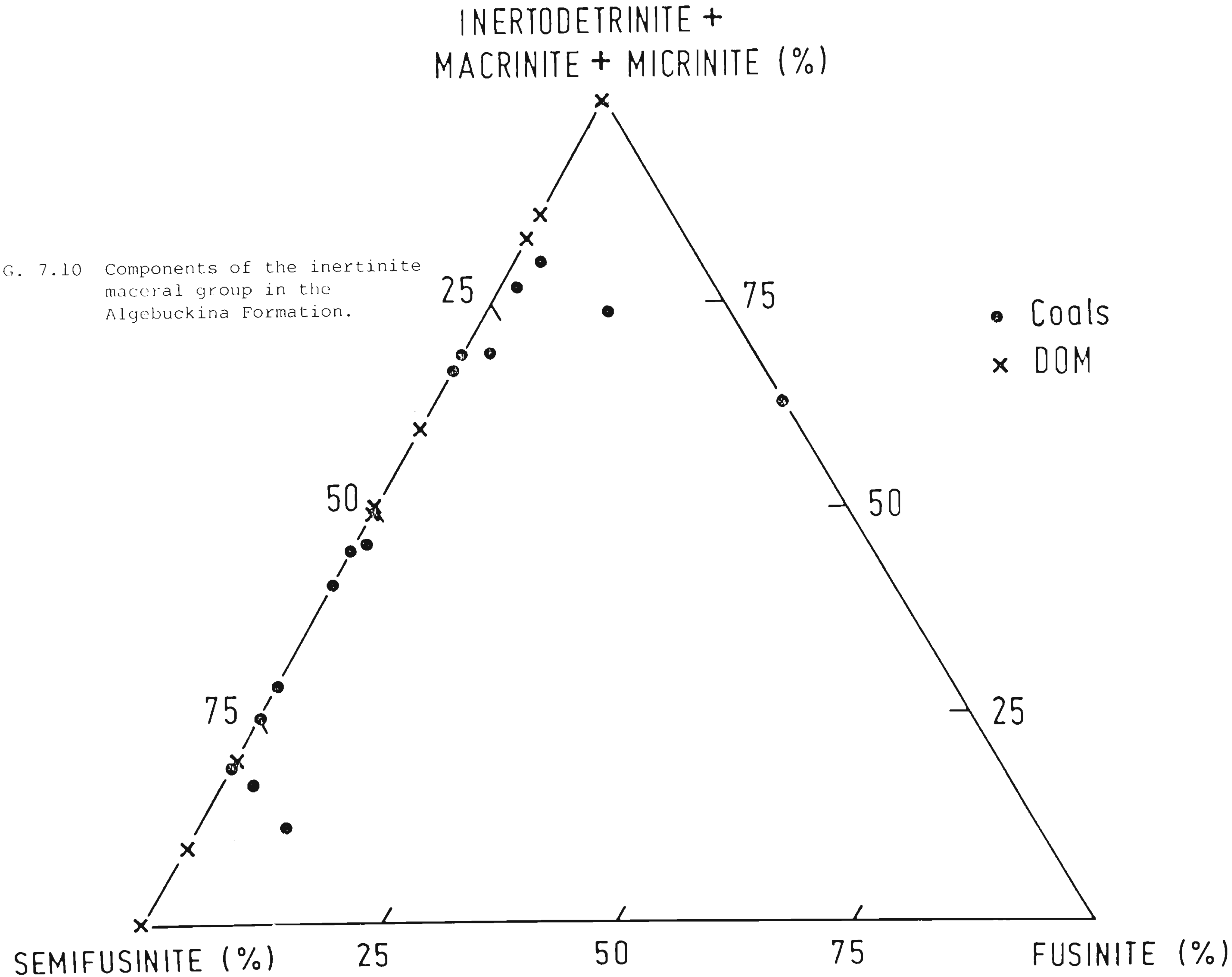


FIG. 7.10 Components of the inertinite maceral group in the Algebuckina Formation.

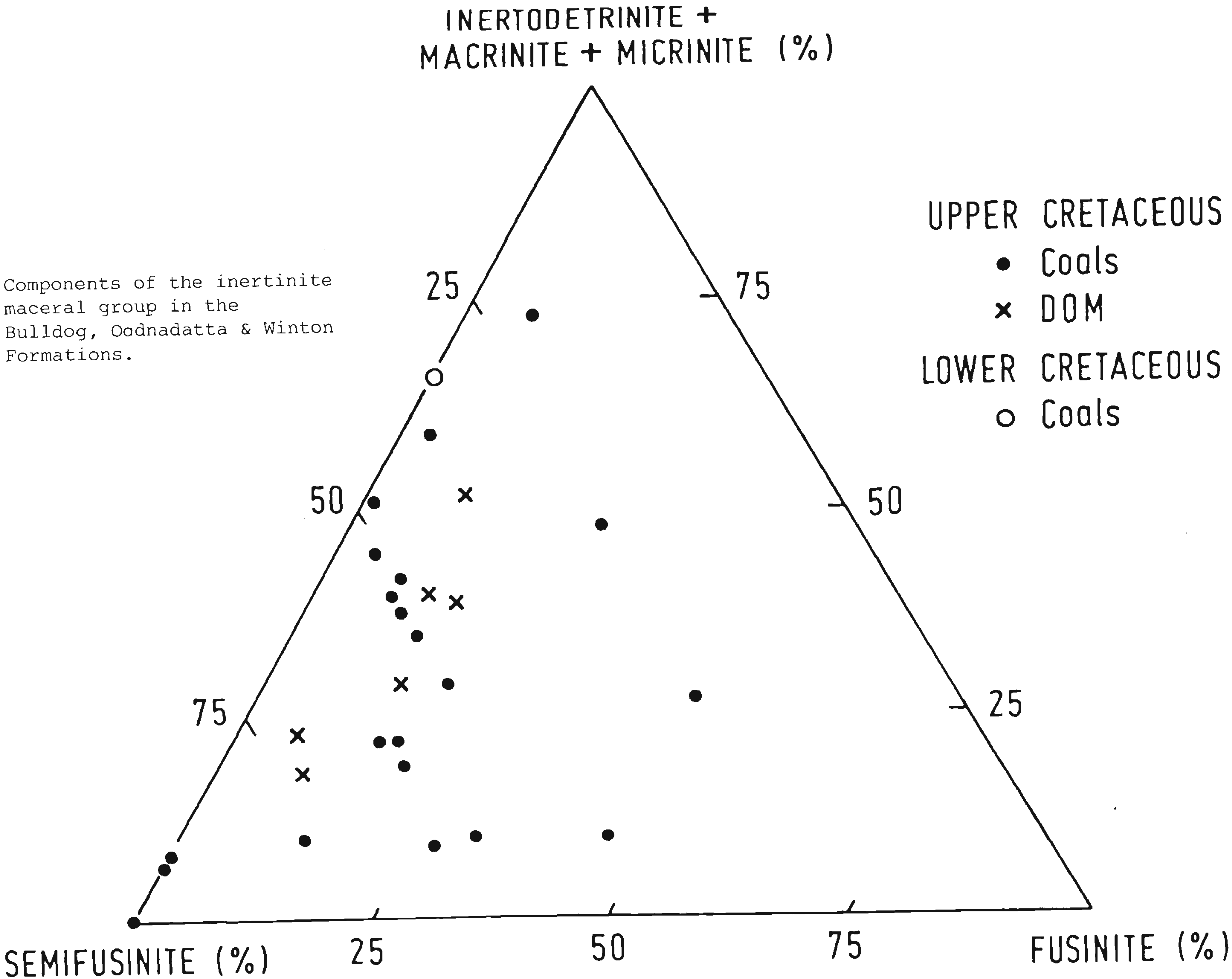


Fig.7.11 Components of the inertinite maceral group in the Bulldog, Oodnadatta & Winton Formations.

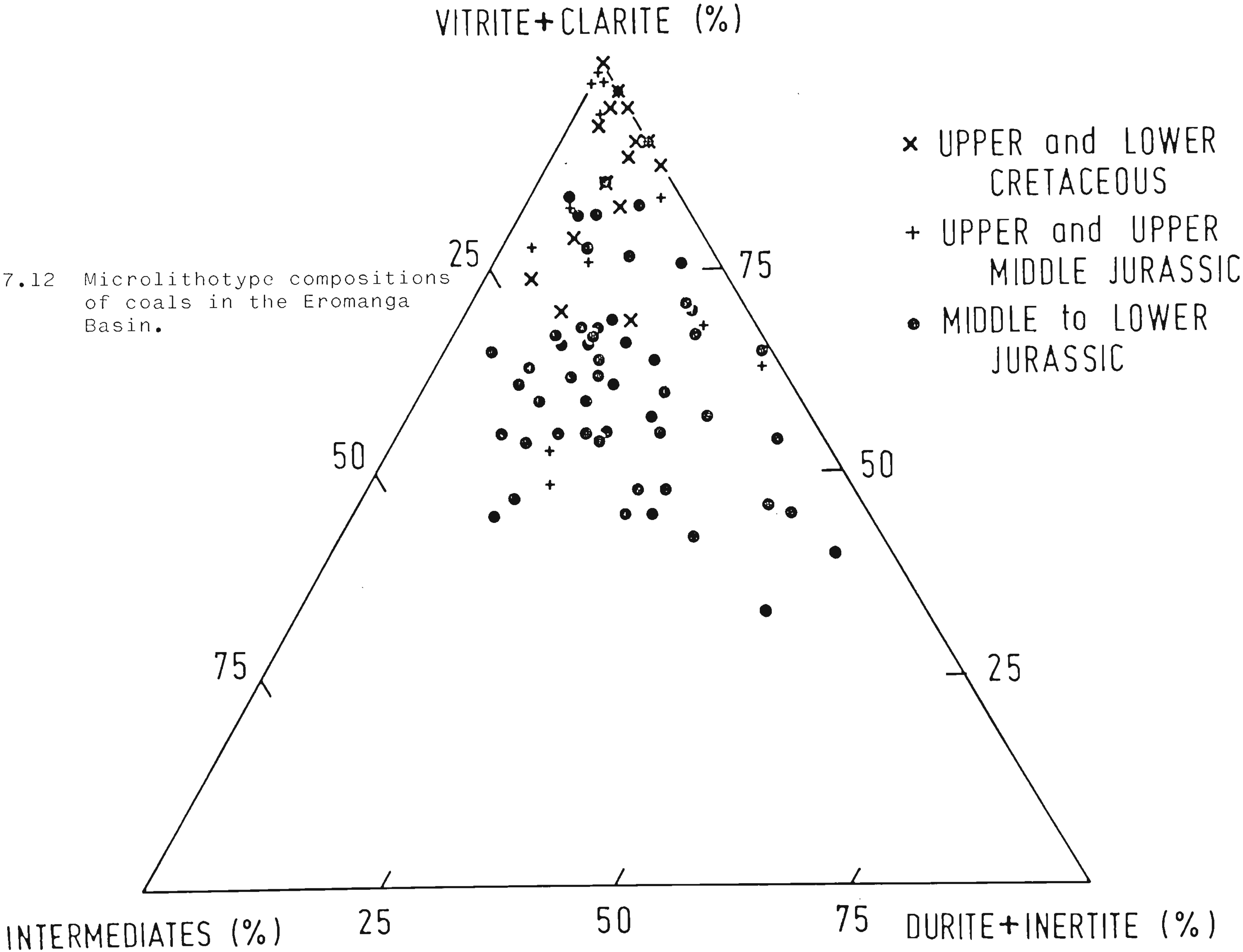


FIG. 7.12 Microlithotype compositions of coals in the Eromanga Basin.

The coals from the younger formations have 49-100% vitrite plus clarite contents (Figure 7.12).

Because of the hand-picking of most of the Poolowanna Formation cuttings, the average amount of DOM in the untreated sediments is not representative. The few bulk samples from Macumba 1 contain an average volume of 1.3% DOM (range to 4%). Volumes of DOM in the younger sediments are:

Upper Cretaceous	0.9%
Lower Cretaceous	0.3%
Upper Jurassic	2.0%

The depths of the samples studied, the amount and type of DOM present, and the microlithotype compositions of the associated coals are shown in Figures 7.13 to 7.16 for Macumba 1, and Figures 7.17 to 7.21 for Poolowanna 1.

7(v) Relationships between DOM and associated coals

The results of the petrographic analyses on the Poolowanna Formation in Macumba 1 are the only ones in a form suitable and of sufficient quantity for statistical testing. Even these data may not be suitable in that most samples have been hand-picked.

The results of statistical testing on the Poolowanna Formation analyses are given in Tables 7.15 to 7.17.

No significant correlations were found between the DOM macerals (V_D, E_D, I_D) and the individual macerals (V_c, E_c, I_c) of the associated coals.

The correlations which are statistically significant at the 5% level are:

E_D with $\frac{V_c}{E_c}$ (Table 7.15)

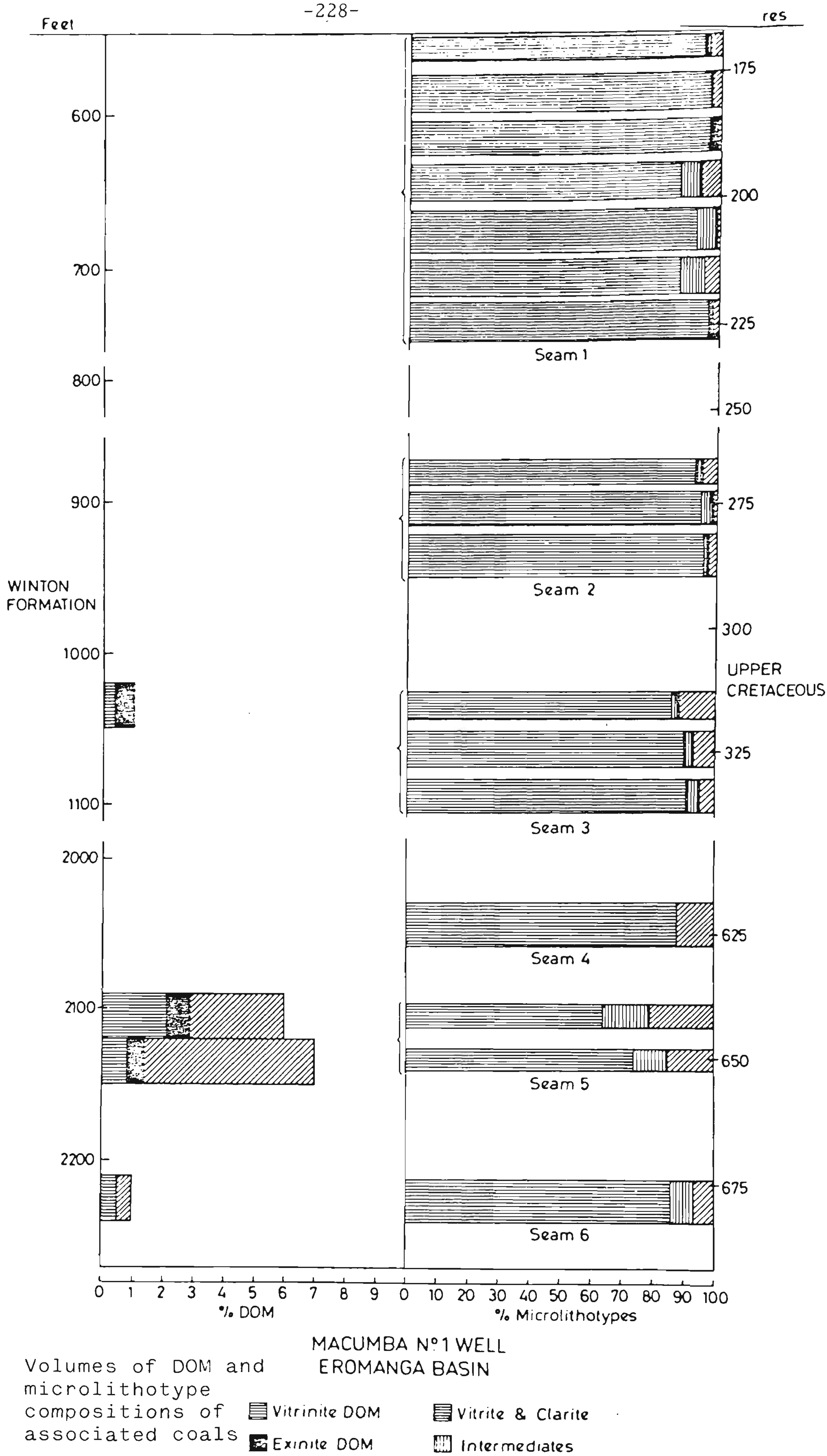


FIG. 7.13 Volumes of DOM and microlithotype compositions of associated coals

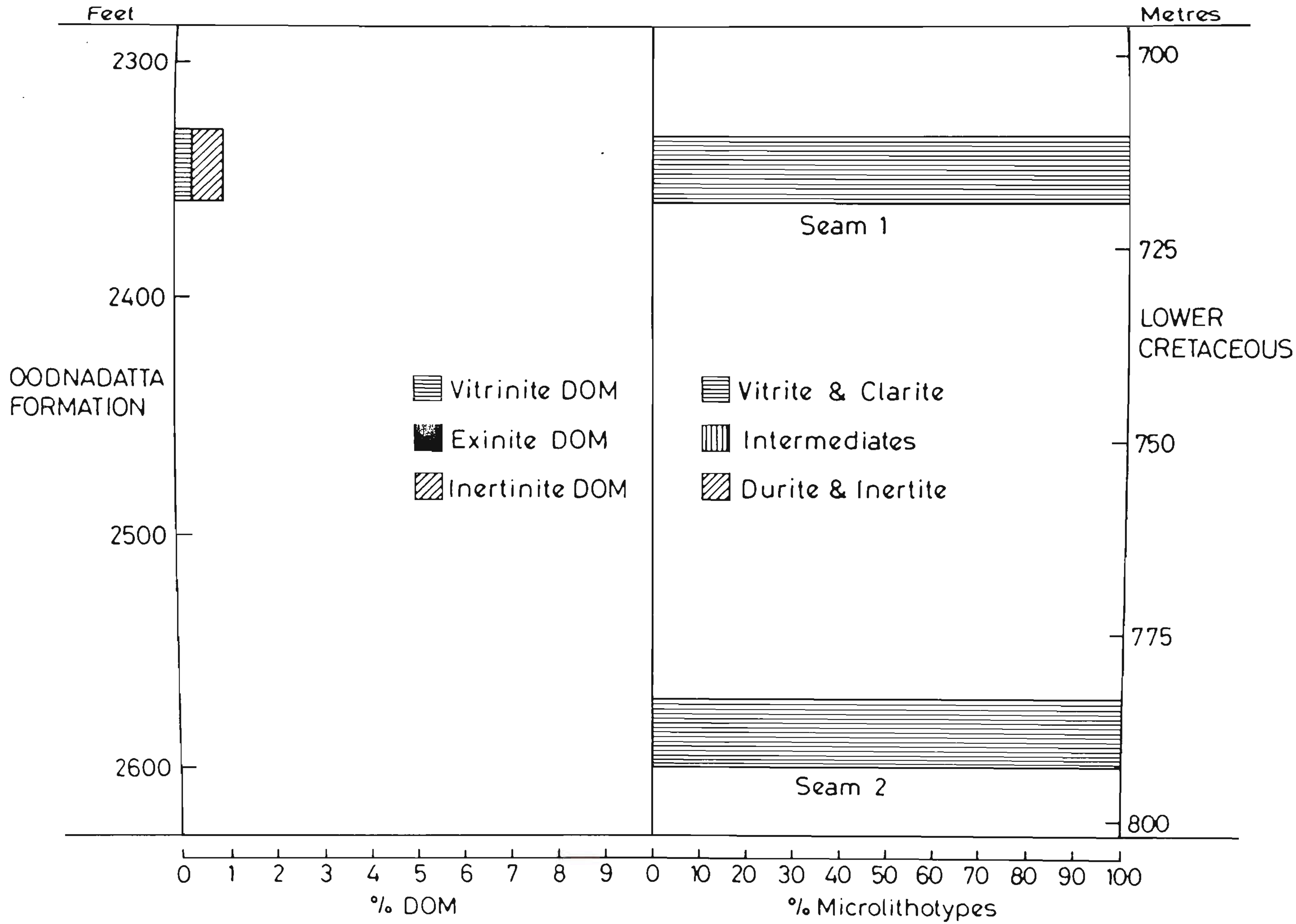


FIG.7.14 Volumes of DOM and microlithotype compositions of associated coals.

MACUMBA No.1 WELL
EROMANGA BASIN

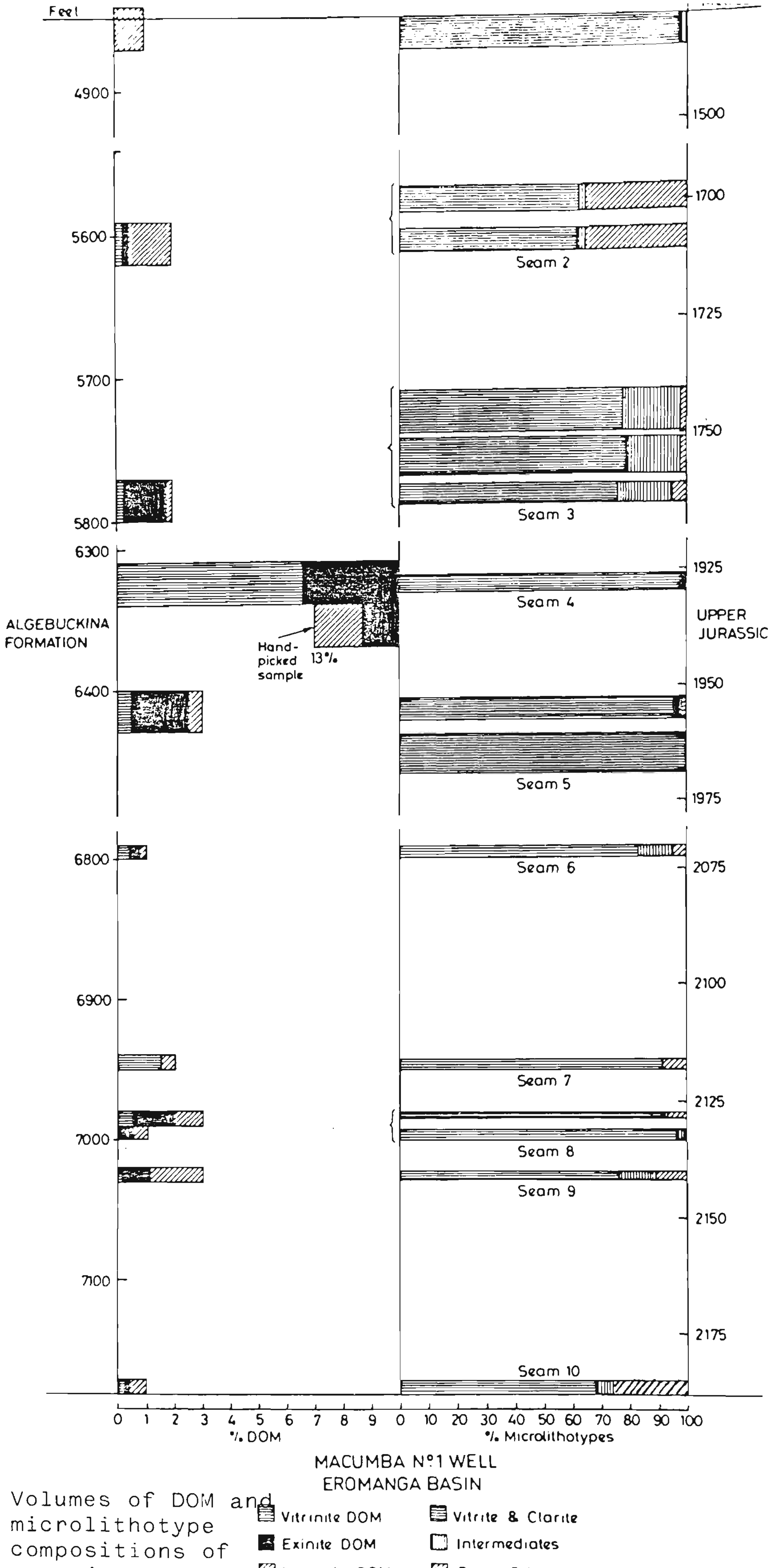


FIG. 7.15 Volumes of DOM and microlithotype compositions of associated coals

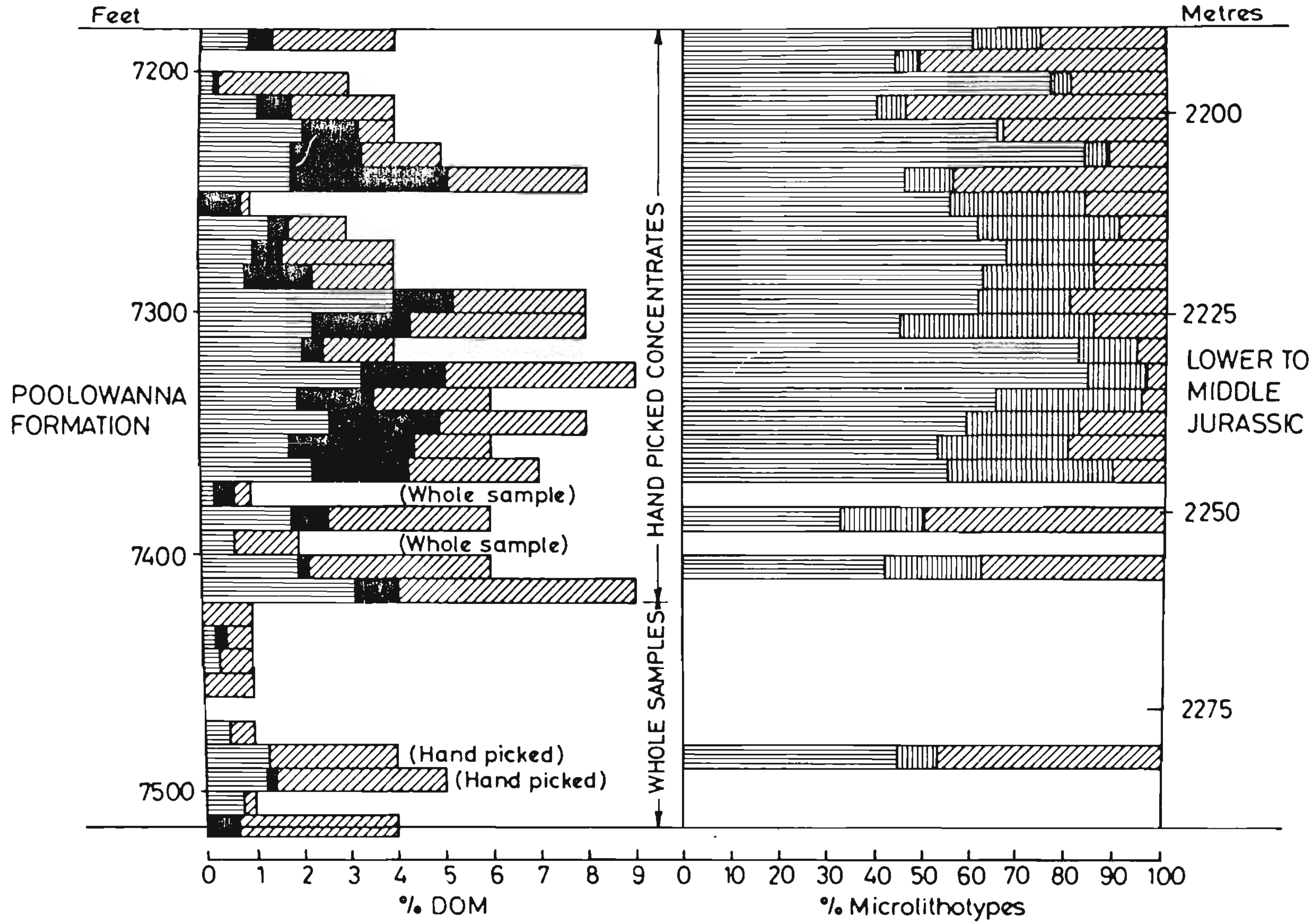


FIG. 7.16 Volumes of DOM and microlithotype compositions of associated coals.

E_D with $\frac{E_c}{I_c}$ (Table 7.15)

E_c with $\frac{V_D}{E_D}$ (Table 7.16)

E_c with $\frac{E_D}{I_D}$ (Table 7.16)

I_D with $\frac{E_c}{I_c}$ (negatively) (Table 7.15)

Exinite DOM increases as the ratio of vitrinite to exinite in the associated coal increases, and also as the ratio of exinite to inertinite in the associate coal increases. (Table 7.15).

Inertinite DOM decreases with an increase in the ratio of exinite to inertinite in the associated coal (Table 7.15).

That is, the ratio of exinite to inertinite DOM correlates positively with the ratio of exinite to inertinite in the associated coals and exinite DOM increases with an increase in vitrinite in associated coal.

7 (vi) Conclusions

The correlations of

E_D with $\frac{E_c}{I_c}$ (Table 5.29)

E_c with $\frac{E_D}{I_D}$

I_D with $\frac{E_c}{I_c}$ (negatively)

were found in the third cycle of the Patchawarra Formation and the whole Patchawarra Formation in Tindilpie 1.

The above three correlations between DOM and associated coals found in Permian organic matter from the Cooper Basin and Jurassic sediments in the Eromanga Basin may be commonly occurring relationships between coals and DOM. The correlations amount to the approximation that a

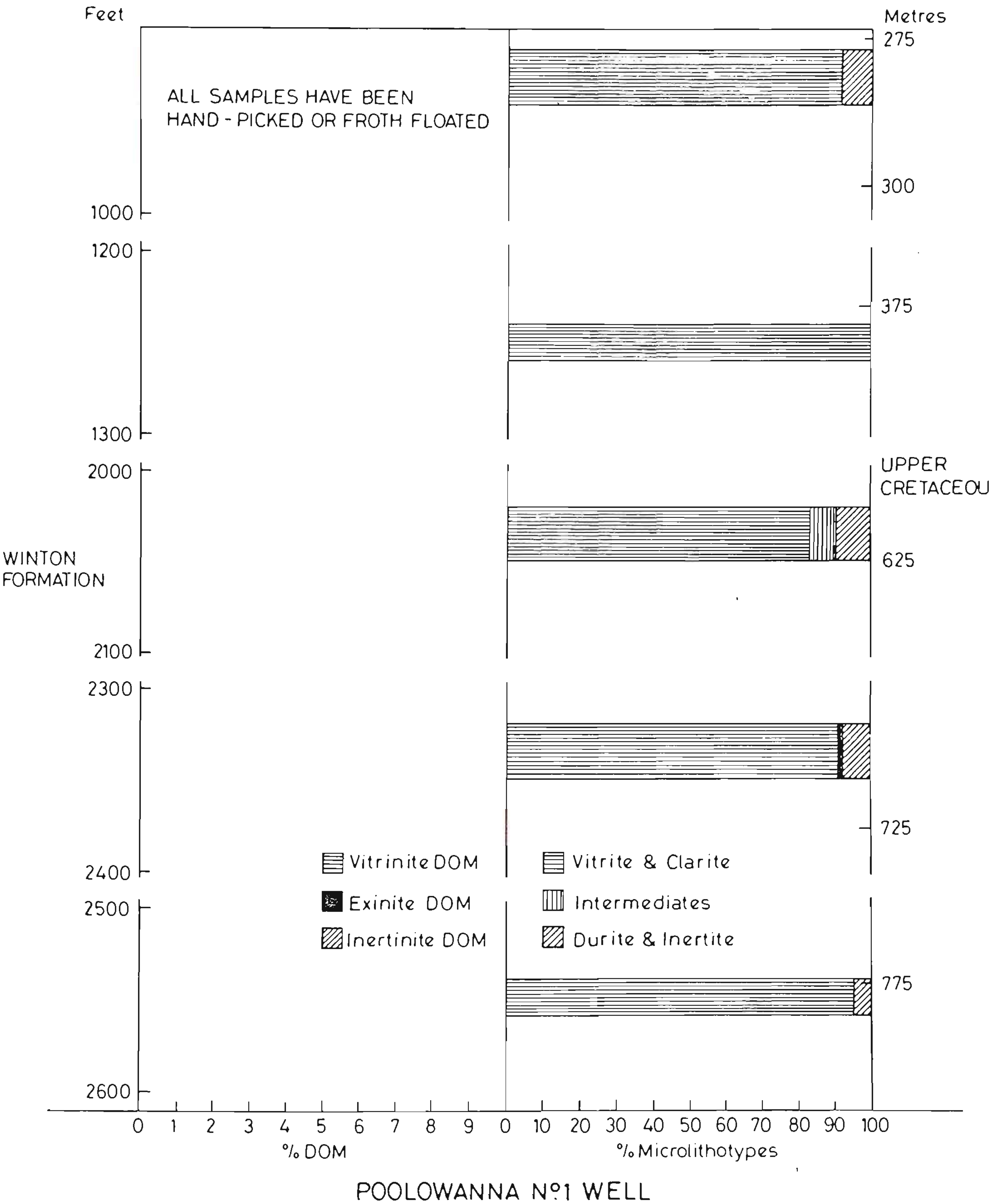


FIG. 7.17 Volumes of DOM and microlithotype compositions of associated coals.

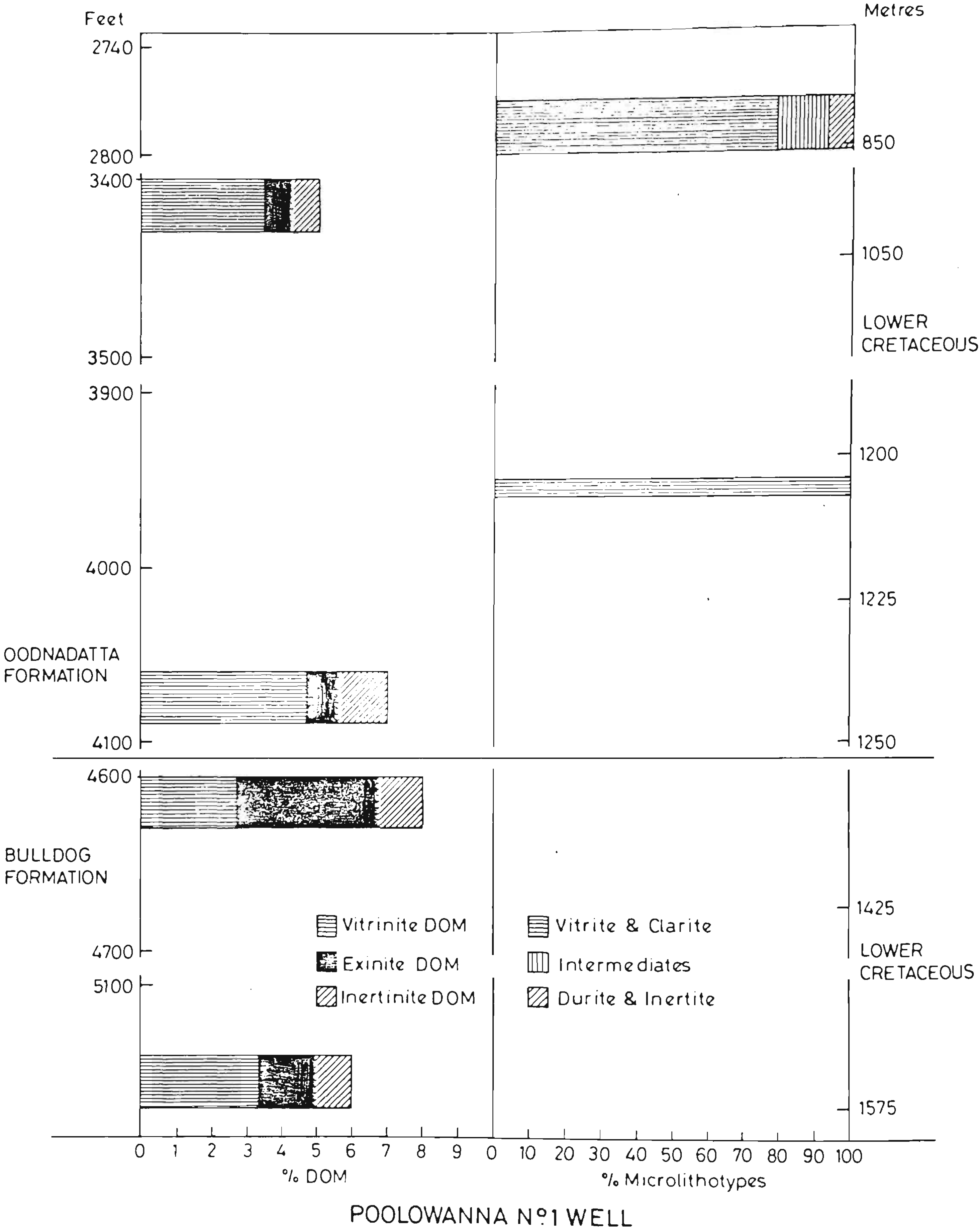


FIG. 7.18 Volumes of DOM and microlithotype compositions of associated coals.

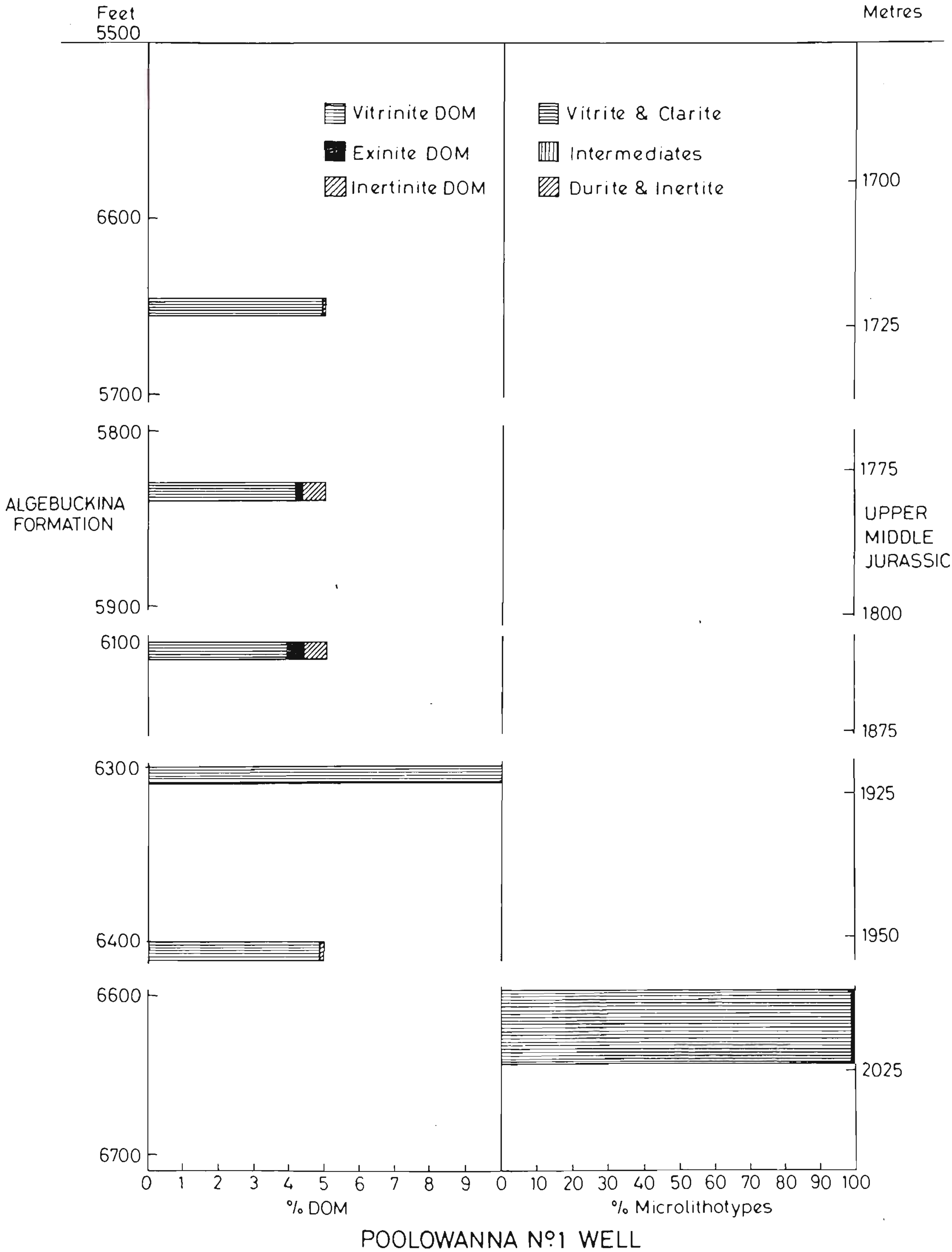


FIG. 7.19 Volumes of DOM and microlithotype compositions of associated coals.

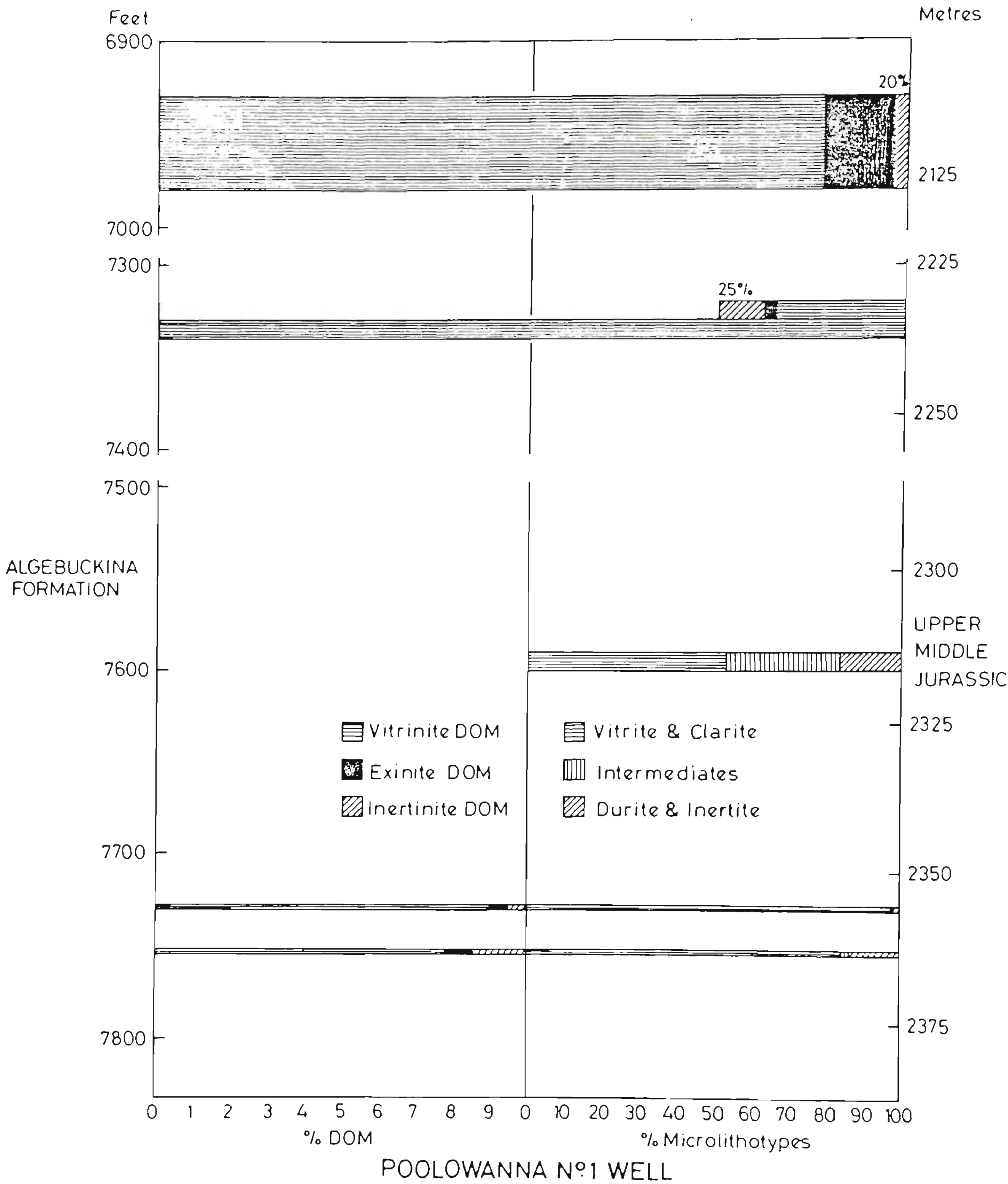


FIG.7.20 Volumes of DOM and microlithotype compositions of associated coals.

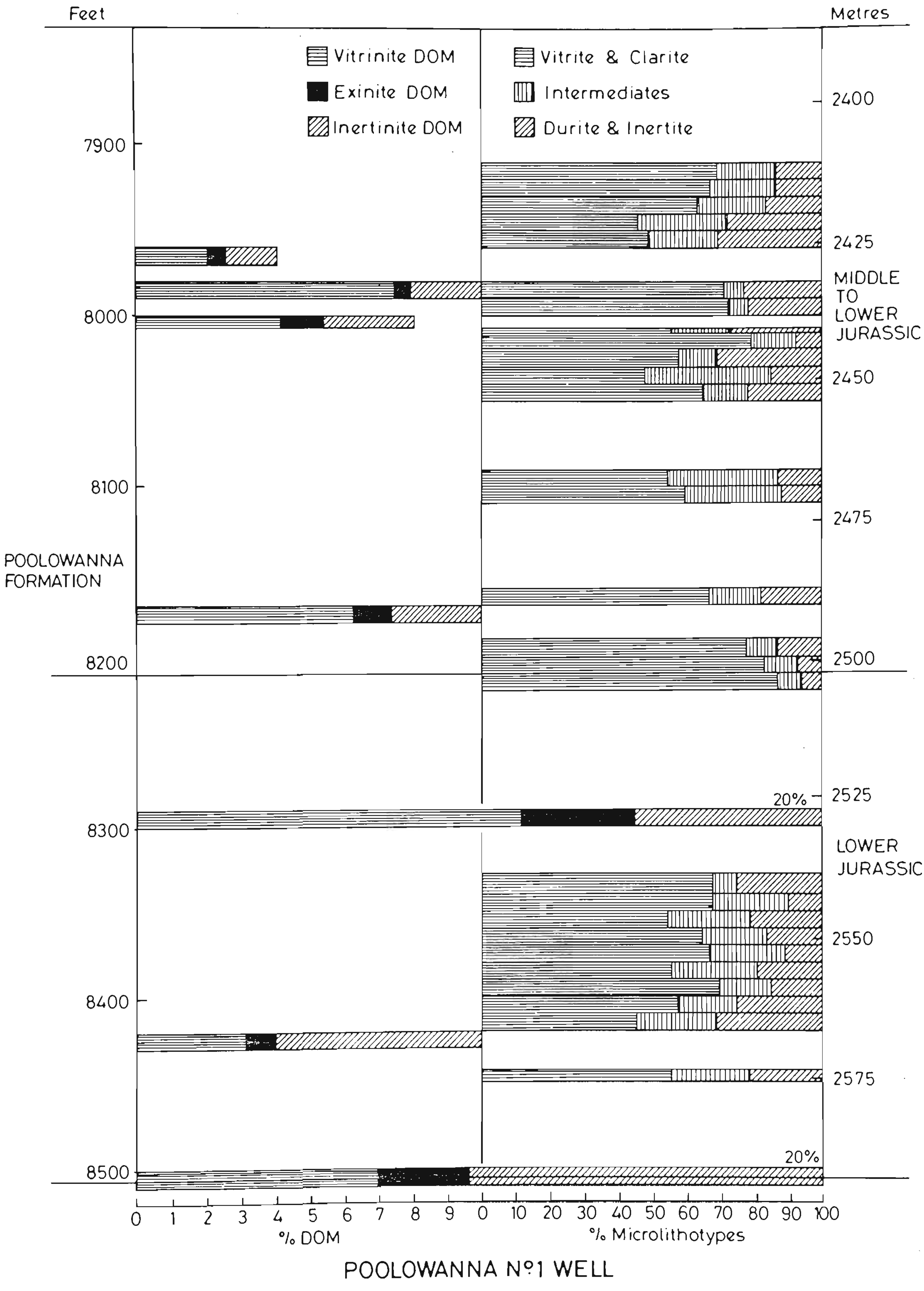


FIG.7.21 Volumes of DOM and microlithotype composition of associated coals.

high exinite content in a coal, is likely to be associated with a high exinite DOM and a low inertinite content in the DOM, in the associated sediments.

The above results suggest that the plant material in a depositional basin simultaneously contributes to the accumulation of coal seams and is distributed through the inorganic sediments as DOM. Unless exinite occurs in the associated coals, it is unlikely that exinite DOM will be found in the sediments. The relationship between inertinite in coals and inertinite DOM is also strong.

Table 7.15 Values of Kendall's τ. Standard deviation of each value is approx. 0.17. Values significant at the 5 per cent level are underlined.

Correlations between the maceral compositions of coals and dispersed organic matter in the Poolowanna Formation, Macumba No.1.

	V_D	E_D	I_D
V_C/E_C	-0.02	<u>-0.34</u>	0.25
E_C/I_C	0.18	<u>0.54</u>	<u>-0.56</u>
I_C/V_C	-0.18	-0.15	0.27

Table 7.16 Values of Kendall's τ. Standard deviation of each value is approx. 0.17. Values significant at the 5 per cent level are underlined.

	V_C	E_C	I_C
V_D/E_D	0.04	<u>-0.41</u>	0.14
E_D/I_D	0.09	<u>0.46</u>	-0.26
I_D/V_D	-0.25	-0.33	0.28

Table 7.17 Values of Kendall's τ. Standard deviation of each value is approx. 0.17. Values significant at the 5 per cent level are underlined.

	V_D/E_D	E_D/I_D	I_D/V_D
V_C/E_C	<u>0.34</u>	-0.31	0.19
E_C/I_C	<u>-0.45</u>	<u>0.56</u>	<u>-0.38</u>
I_C/V_C	0.07	-0.19	0.24

Plate 7.1

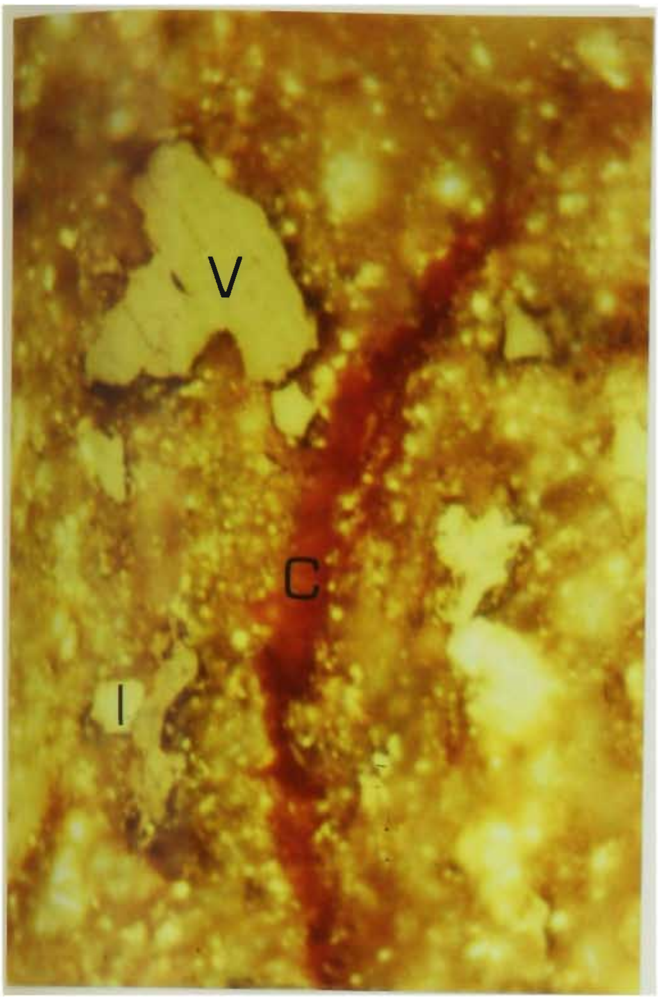
(a) Dispersed organic matter, vitrinite (V), cutinite (C) and inertodetrinite (I) from the Triassic of the Simpson Desert Basin, x 465.

(b) Dispersed organic matter, vitrinite (V), cutinite (C) and inertodetrinite (I) from the Upper Jurassic of the Eromanga Basin; x 465.

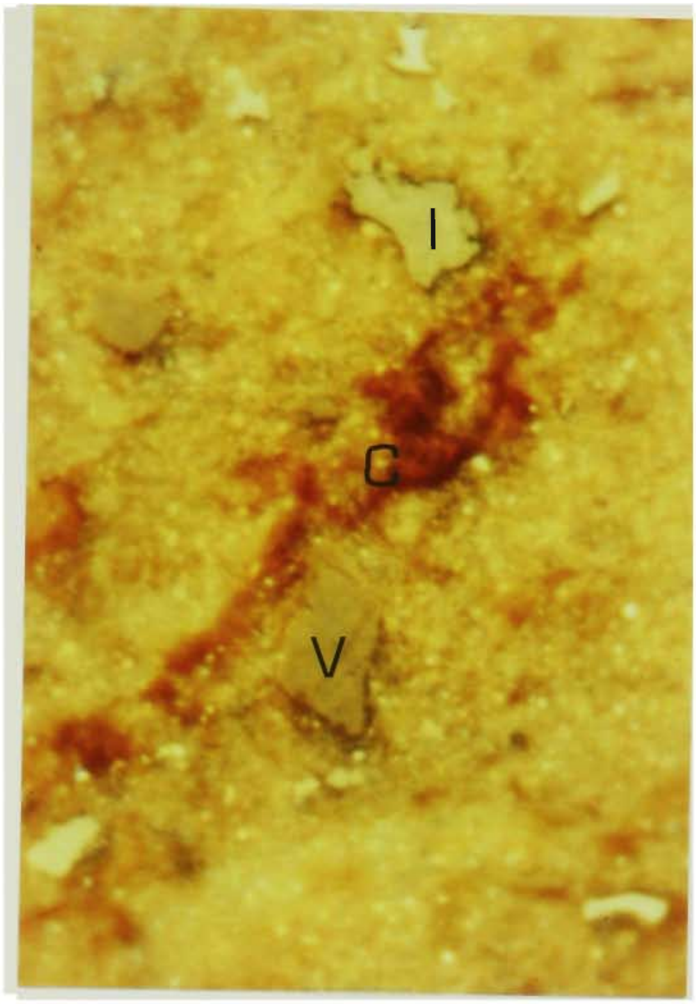
(c) Coal consisting of vitrinite (V) and suberinite (SU) from the Upper Cretaceous of the Eromanga Basin; x 465.

(d) Dispersed organic matter, vitrinite (V), sporinite (S) and inertinite (I) (semifusinite) from the Upper Jurassic of the Eromanga Basin; x 465.

All photographs have been taken using plane polarised reflected light with oil immersion.

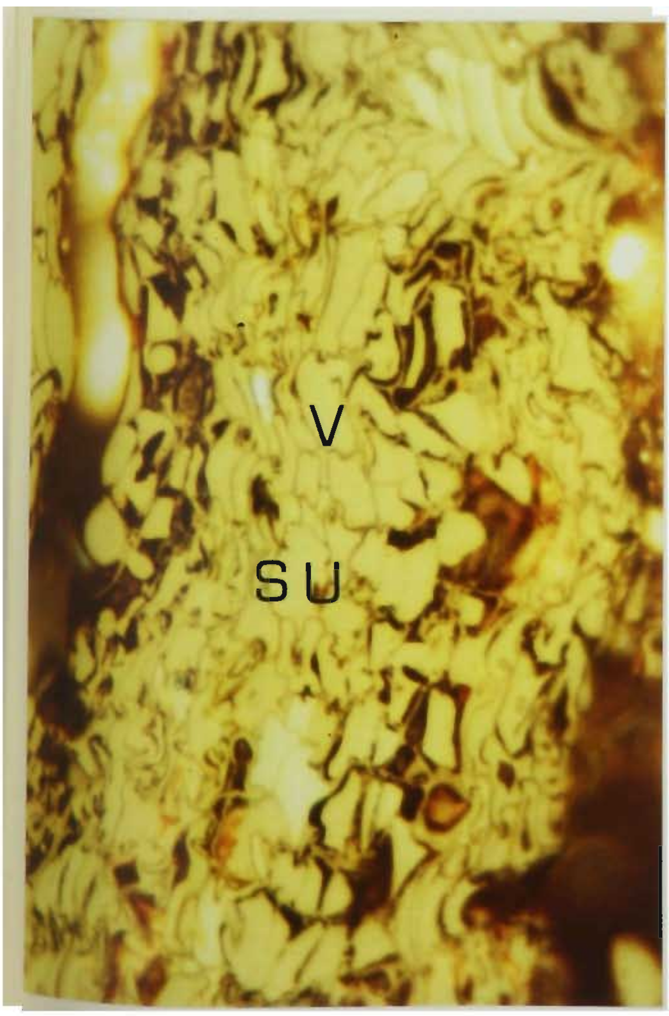


(a)



(b)

PLATE 7.1



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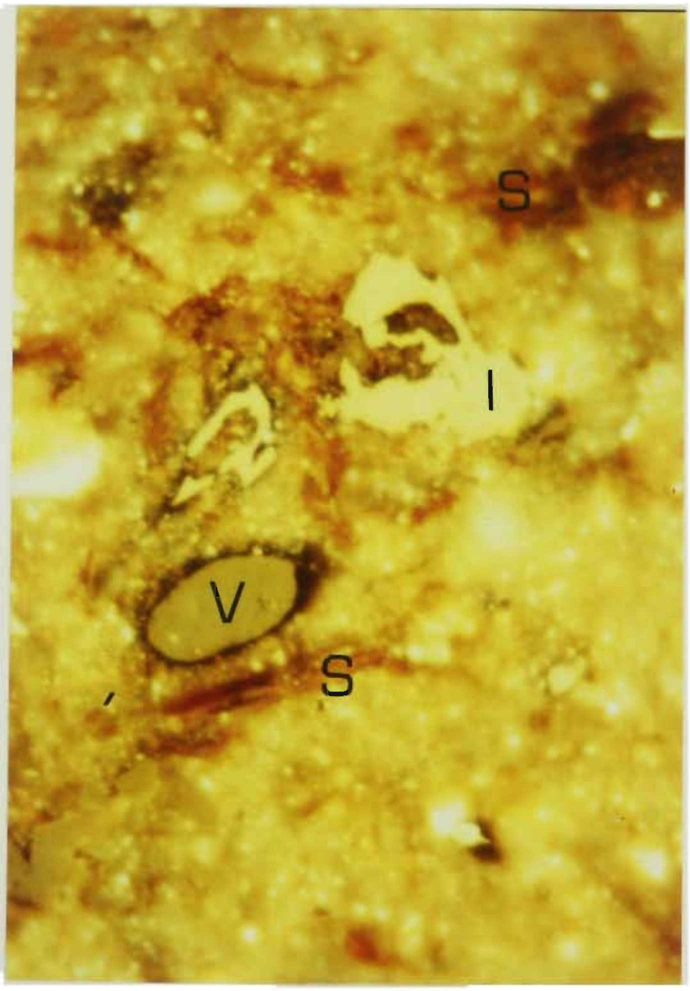


(d)

8. THE RELATIONSHIP BETWEEN COAL MICROLITHOTYPES AND SEDIMENTARY ENVIRONMENTS IN THE PATCHAWARRA TROUGH, COOPER BASIN

8(i) Introduction

Coal microlithotypes used in correlation with dispersed organic matter in associated sediments, have been related to the depositional environments of the Gidgealpa Group as interpreted by Thornton (1979).

The rock units of the Gidgealpa Group are diachronous, a feature documented by the relationship of the rock units to the palynological Stages (Fig.8.1, Table 2.1) (Thornton, 1979). The stratigraphic sections also show lateral facies changes within the rock units. Major directions of facies changes are from east to west, or vice versa.

Thornton has determined the depositional history of the Cooper Basin by studying the thickness and facies distributions of the palynological Stages and their component rock units. "Time-rock" units, which have been defined as "tabular slices of sedimentary rocks bounded by planes of synchroneity ('time planes')"are the bases used by Thornton for his palaeogeographic analyses.

However, where the inclusion of two widely variable facies in a time-rock unit serves only to obscure the palaeogeography, Thornton has subdivided the unit into facies defined rock units. For example, Stage 3 of the Patchawarra Formation includes the upper part of the braided fluvial Tirrawarra Formation and the lower part of the meandering fluvial Patchawarra Formation. The inclusion of a relatively thick portion of the Tirrawarra Sandstone can disproportionately affect the sand to shale ratios from one area to another in a non-uniform way. Thornton has therefore further divided Stage 3 into Stage 3' which includes only the facies of the Patchawarra Formation.

As the study here is concerned with the relationship between coal type and depositional environment, these subdivisions based on facies only are ideal for the purpose. Upper Stage 4 and Upper Stage 4 have similarly been further subdivided into Upper Stage 4' and Upper Stage 5' (Fig. 8.3).

Microlithotype analyses from the wells Tirrawarra 2 and Cuttapirrie 1 were added to those from Tindilpie 1 and Mudrangie 1, in the Patchawarra Trough (Fig. 8.2).

Tindilpie 1 and Tirrawarra 2 are in the central, thicker part of the trough, and Tindilpie 1 contains the thickest known section of the Gidgealpa Group. Mudrangie 1 is adjacent to a structural high, the Gidgealpa-Merrimelia-Innamincka Trend; Cuttapirrie 1 is on the northern edge of the basin.

The relationships between coal microlithotypes and depositional environments were examined to determine the usefulness or otherwise of microlithotypes as indicators of sedimentary environments in the Patchawarra Trough (Smyth, 1985).

8(ii) Analyses

The number of microlithotype analyses carried out on each well is given in Table 8.1. Microlithotype analyses representing parts of the same seam were combined, using weighted percentages, and a whole seam composite calculated for the seam.

8(iii) Depositional Environments

Table 8.2 and Fig.8.3 show the depositional environments proposed by Thornton for each formation in the four wells analysed. Schematic representations of Thornton's environments are given in Fig. 8.4.

Table 8.1 The Number of Microlithotype Analyses Performed on Coals from Four Wells in the Patchawarra Trough

Well	No. of analyses	No. of seams represented
<u>Tindilpie 1</u>		
Toolachee Formation	8	6
Roseneath Shale	4	4
Epsilon Formation	10	5
Murteree Shale	1	1
Patchawarra Formation		
Upper Stage 4'	11	8
Lower Stage 4	3	3
Stage 3'	31	19
<u>Tirrawarra 2</u>		
Toolachee Formation	5	3
Epsilon Formation	1	1
Murteree Shale	-	-
Patchawarra Formation		
Upper Stage 4'	4	2
Lower Stage 4	1	1
Stage 3'	25	11
<u>Mudrangie 1</u>		
Toolachee Formation	7	3
Epsilon Formation	2	1
Murteree Shale	-	-
Patchawarra Formation		
Lower Stage 4	4	2
Stage 3'	10	5
<u>Cuttapirrie 1</u>		
Patchawarra Formation		
Upper Stage 4'	6	5
Lower Stage 4	2	2
Stage 3'	8	8

Table 8.2 Depositional Environments in the Gidgealpa Group According to Thornton (1979)

Formation	Tindilpie 1	Tirrawarra 2	Mudrangie 1	Cuttapirrie 1
Toolachee (Upper Stage 5')	area dominated by channel deposits	area dominated by coal swamps*	area dominated by coal swamps	not present
Roseneath Shale (Lower Stage 5)	restricted sea	not present	not present	not present
Epsilon (Uper Stage 4)	upper coastal plain (coal-rich)	upper coastal plain (coal-rich)	upper coastal plain (coal-rich)	not present
Murteree Shale (Upper Stage 4)	restricted sea	restricted sea	restricted sea	not present
Patchawarra (Upper Stage 4')	channel belt	upper coastal plain (coal-rich)	upper coastal plain (coal-rich)	lower coastal plain (coal-poor)
Patchawarra (Lower Stage 4)	area dominated by channel deposits	area dominated by channel deposits	area dominated by overbank deposits, lakes and swamps	area dominated by overbank deposits, lakes and swamps
Patchawarra (Stage 3')	area dominated by overbank deposits, lakes and swamps	area dominated by overbank deposits, lakes and swamps	area dominated by overbank deposits, lakes and swamps	area dominated by overbank deposits, lakes and swamps
Tirrawarra	braided stream	braided stream	braided stream	not present

* In Tirrawarra 2, the Toolachee Formation lies on the boundary between an "area dominated by coal swamps" and an environment "dominated by channel deposits." In this study the "area dominated by coal swamps" environment has been used.

Table 8.3 Percentage Distribution of the Coal Seams from the Gidgealpa Group in the Proposed Sedimentary Environments

Formation	1	2	3	4	5	6	7
Toolachee		50	50				
Roseneath Shale							100
Epsilon					100		
Murteree Shale							100
Patchawarra							
Upper Stage 4'				54	13	33	
Lower Stage 4	50		50				
Stage 3'	100						

1 : area dominated by overbank deposits, lakes and swamps

2 : area dominated by coal swamps

3 : area dominated by channel deposits

4 : channel belt

5 : upper coastal plain (coal-rich)

6 : lower coastal plain (coal-poor)

7 : restricted sea

Table 8.4 Microlithotype compositions (%) around which coals from each formation in the Gidgealpa Group are concentrated

Formation	Vitrite + Clarite	Intermediates*	Durite + Inertite
Toolachee	20	30	50
Roseneath Shale	35	45	20
Epsilon	28	47	25
Murteree Shale	34	47	19
Patchawarra			
Upper Stage 4'	41	37	22
	30	30	40
	13	29	58
Lower Stage 4	19	38	43
Stage 3'	15	31	54

* Duroclarite, clarodurite, vitrinertite

Table 8.5 Number of seams from different formations of the Gidgealpa Group in each sedimentary environment

Environment	Formations represented
Area dominated by overbank deposits, lakes and swamps	Lower Stage 4 : 4 seams (9%) Stage 3' : 43 seams (91%)
Area dominated by coal swamps	Toolachee : 6 seams (100%)
Area dominated by channel deposits	Toolachee : 6 seams (60%) Lower Stage 4 : 4 seams (40%)
Channel belt	Upper Stage 4' : 8 seams (100%)
Upper coastal plain (coal-rich)	Epsilon : 7 seams (78%) Upper Stage 4' : 2 seams (22%)
Lower coastal plain (coal-poor)	Upper Stage 4' : 5 seams (100%)
Restricted sea	Roseneath Shale : 4 seams (80%) Murteree Shale : 1 seam (20%)

Table 8.6 Microlithotype compositions (%) around which coals from various depositional environments in the Gidgealpa Group are concentrated

Environment	Vitrite + clarite	Intermediates*	Durite + inerite
Area dominated by overbank deposits, lakes and swamps	18	31	51
Area dominated by coal swamps	19	27	54
Area dominated by channel deposits	25	34	41
Channel belt	41	37	22
Upper coastal plain (coal-rich)	20 (small) and 28	30 47	50 25
Lower coastal plain (coal-poor)	15	25	60
Restricted sea	35	45	20

* Duroclarite, clarodurite, vitrinertite

Despite the use of the term "restricted sea" no evidence of a marine origin has been found for any of the rocks. Thornton himself describes the Murteree Shale as having been "deposited from one large lake with dimensions of about 250 x 150km². The term "restricted sea" has been replaced by "large lake".

8(iv) The relationships between coal microlithotypes and depositional environments

Microlithotypes, which describe how macerals are associated with one another, are better indicators of coal depositional environments than are macerals (Stach et al., 1975). Microlithotype compositions of the coal seams in the Gidgealpa Group have been related to Thornton's depositional environments, which were reconstructed largely from data on the inorganic sediments.

The microlithotype compositions of coal seams from the four wells are plotted in Fig. 8.5, where they are grouped with respect to the formations in which they occur.

Each Gidgealpa Group formation, as seen by Thornton, represents one or more depositional environments (Fig. 8.1, Table 8.2). Stage 3' represents only one environment; Lower Stage 4, two; Upper Stage 4', three; the Murteree Shale, Epsilon Formation and Roseneath Shale, one each; and the Toolachee Formation, two (Table 8.3).

If coal type is dependent on depositional environment, coals from the Epsilon Formation and Stage 3' should be concentrated into one area each in Fig. 8.5 as they represent just one environment; Lower Stage 4 and Upper Stage 4' coals should be concentrated around two and three areas respectively; Murteree and Roseneath Shale coals should concentrate around the same area, as they have formed in the same environment, and the Toolachee Formation should have two areas of concentration.

In Fig. 8.6 the density of points plotted for Stage 3' coal compositions has been contoured. The contours are an estimate of the trivariate probability density. They join areas where data points are equally dense. The outermost contour joins areas in which at least one datum point falls, the second contour, two data points, etc. If only a few data points are being contoured, only a few density contour lines results; the more points, the more contour lines. The central point of the contours is 15% vitrite plus clarite, 31% intermediates, 54% durite plus inertite (Table 8.4). The density contours for the other formations are shown in Figs. 8.7 to 8.11, Lower Stage 4 has only one concentration area (Fig. 8.7).

Upper Stage 4' is concentrated about three well-separated centres (Fig. 8.8). The Murteree Shale is represented by one seam only, which lies in the area of concentration of the Roseneath Shale. (Fig. 8.9). The Epsilon Formation has the one centre of concentration (Fig. 8.10), and the Toolachee Formation also has one concentration centre (Fig.8.11).

In Fig. 8.12 the microlithotype compositions of the coals are grouped and plotted with respect to their depositional environments given in Table 8.2. The "area dominated by overbank deposits, lakes and swamps" includes coals from Stage 3' and Lower Stage 4 (Table 8.5). The "area dominated by coal swamps" is Toolachee Formation seams only, and the "area dominated by channel deposits" includes coals from Lower Stage 4 and the Toolachee Formation. "Channel belt" coals are from Upper Stage 4' only. The 'upper coastal plain (coal-rich)' includes coals from the Epsilon Formation and Upper Stage 4', the "lower coastal plain (coal-poor)'" includes coals from the Upper Stage 4' only, and the "large lake" environment includes coals from the Murteree and

Roseneath Shales.

Coals from the "area dominated by overbank deposits, lakes, and swamps" have been density contoured in Fig. 8.13. They concentrate about one area in the triangle, the central point of which is 18% vitrite plus clarite, 31% intermediates, 51% durite plus inertite (Table 8.6). Coals from the other sedimentary environments, listed in Table 8.5, have been density contoured in Figs. 8.14 to 8.18. The microlithotype compositions of their central concentration points are listed in Table 8.6.

For simplification the central points of the formation density contours and the depositional environment density contours are plotted in Fig.8.19.

concentration centre
Several /points for formations and environments coincide when both are represented by the same seams. These are: "channel belt" and Upper Stage 4', "large lake" and Roseneath Shale, "upper coastal plain" and Epsilon Formation. The other points for the formations lie at various distances from environment points.

Contours which include at least 80% of the microlithotype compositions of the coal seams in the various environments are drawn on Fig.8.19. The degrees of overlap shown in Fig. 8.19 range from slight, "channel belt" and "area dominated by channel deposits", for example to complete. The "area dominated by overbank deposits, lakes and swamps" includes within its boundary virtually all of "lower coastal plain" and "area dominated by coal swamps", as well as most of the "area dominated by channel deposits" and much of "upper coastal plain". The palaeogeographical interpretations were made by Thornton using lithofacies maps as guides. It is difficult to envisage, in terms of coal accumulation, what the differences are between the environments of "area dominated by coal swamps" and the "area dominated by overbank deposits, lakes and swamps", for example. These two environments are therefore combined into one environment of "area dominated by coal swamps". Although these enclosures overlap, several environments are well-separated from one another. In these instances the microlithotype compositions of the coals would be useful in differentiating depositional environments.

Coals which accumulated near a large lake can be distinguished from those of the : .

(i) lower coastal plain,

(ii) area dominated by coal swamps,

while channel belt coals can be distinguished from those of the:

(i) lower coastal plain

(ii) upper coastal plain (slight overlap),

(iii) area dominated by coal swamps;

and lower coastal plain can be differentiated from those of the upper coastal plain using their microlithotype compositions.

8(v) Conclusions

In the Patchawarra Trough, microlithotype compositions of coal seams formed in relatively wet environments - large lake and channel belt coals - are distinctly different from the coals of:

(i) the lower coastal plain,

(ii) area dominated by coal swamps.

Coals from the large lake and channel belt environments have formed where water is permanent, maintaining water=logged conditions of peat accumulation. Relative to these two environments the lower coastal plain and area dominated by coal swamps are drier and more oxidising.

Lower coastal plain coals have more durite plus inertite than upper coastal plain coals.

Large lake and channel belt coals centre round compositions of 35-41% vitrite plus clarite, 45-37% intermediates, 20-22% durite plus inertite. Coals from (i) and (ii) have compositions 15-19% vitrite plus clarite, 25-31% intermediates, 51-60% durite plus inertite.

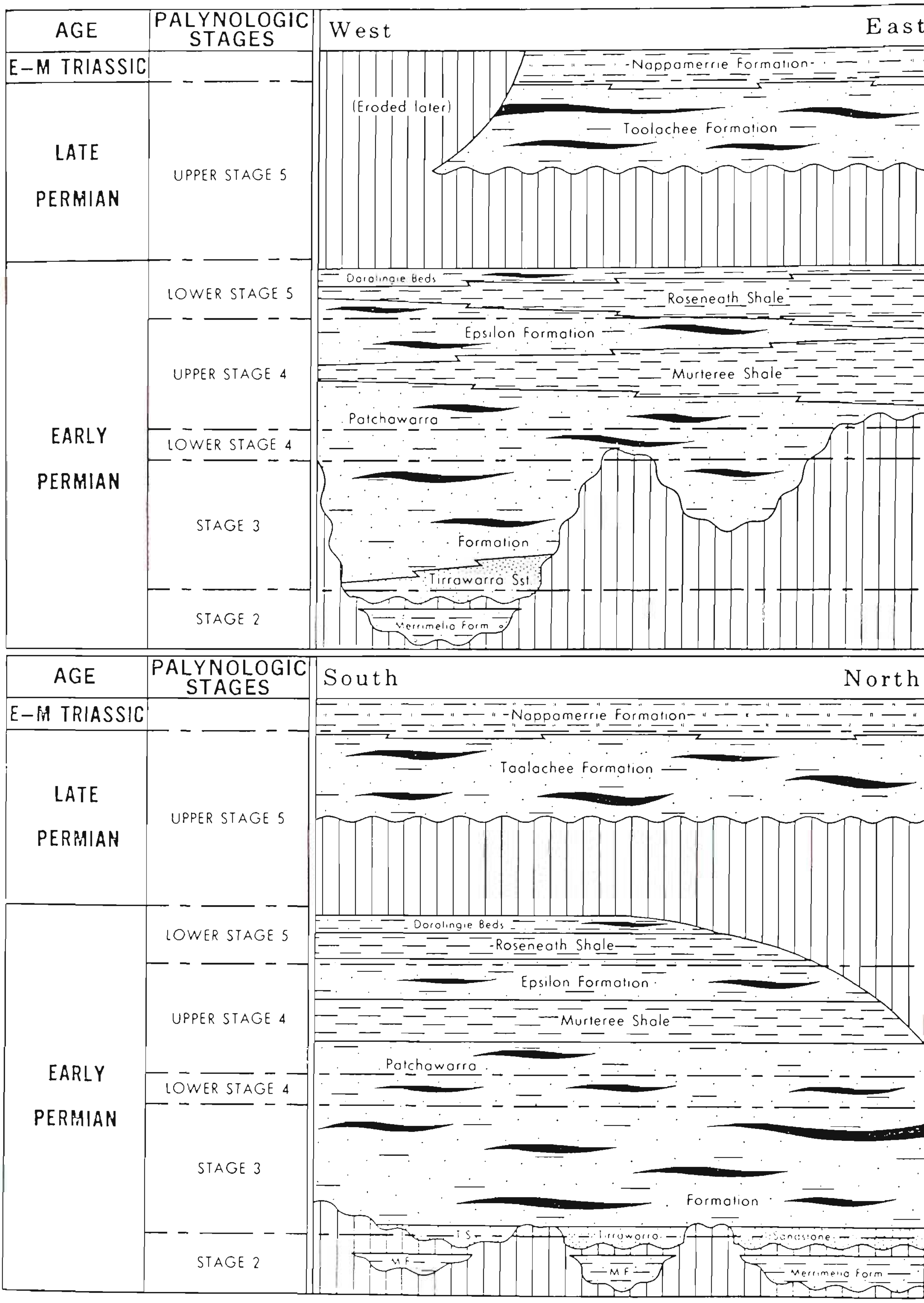


FIG. 8.1 East-west and north-south diagrammatic sections across the Cooper Basin (after Thornton, 1979)

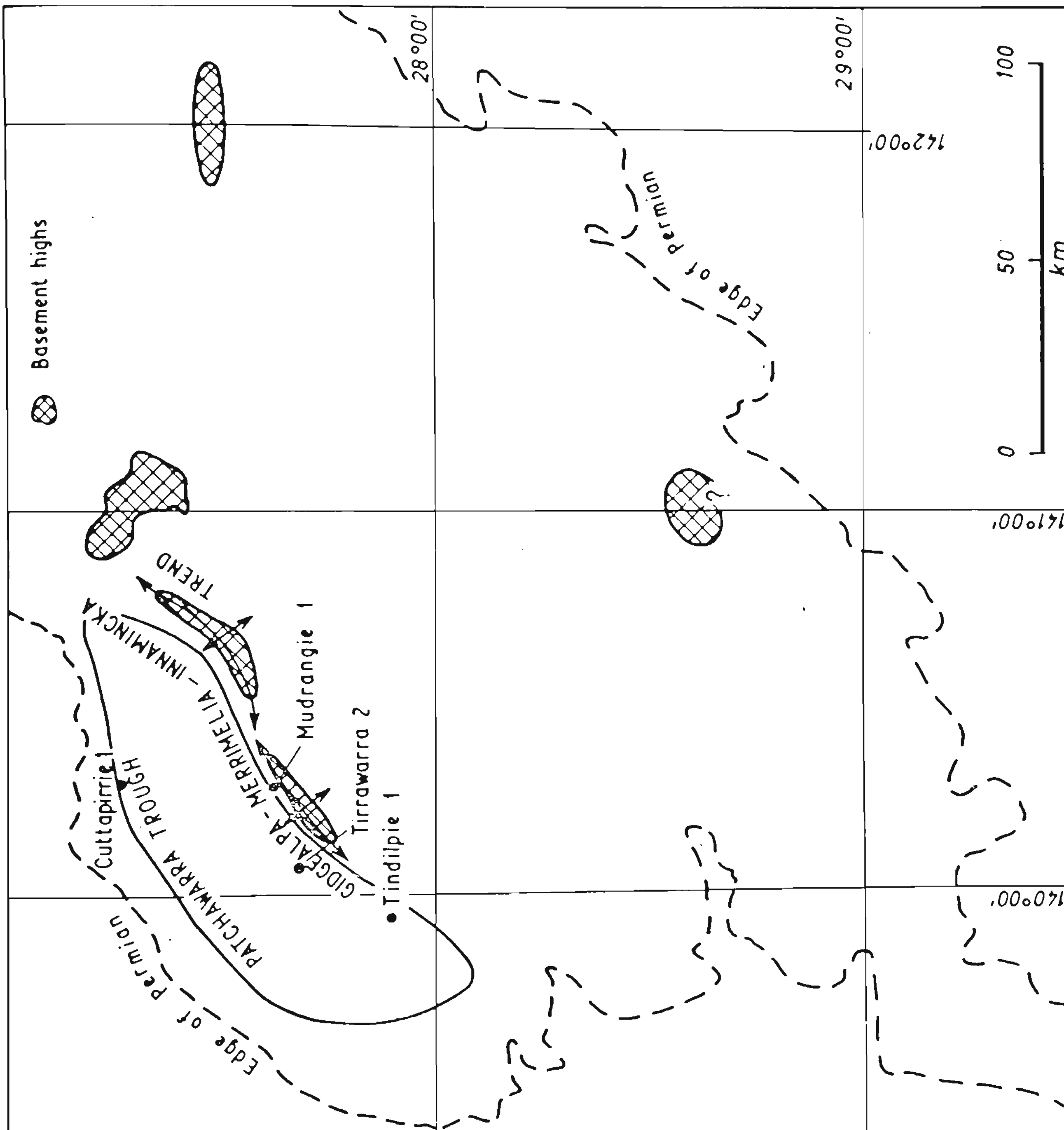


FIG. 8.2 Plan of the southern Cooper Basin showing the locations of the Cuttapirrie, Tirrawarra, Mudrangie, and Tindilpie wells in the Patchawarra Trough (after Thornton, 1979).

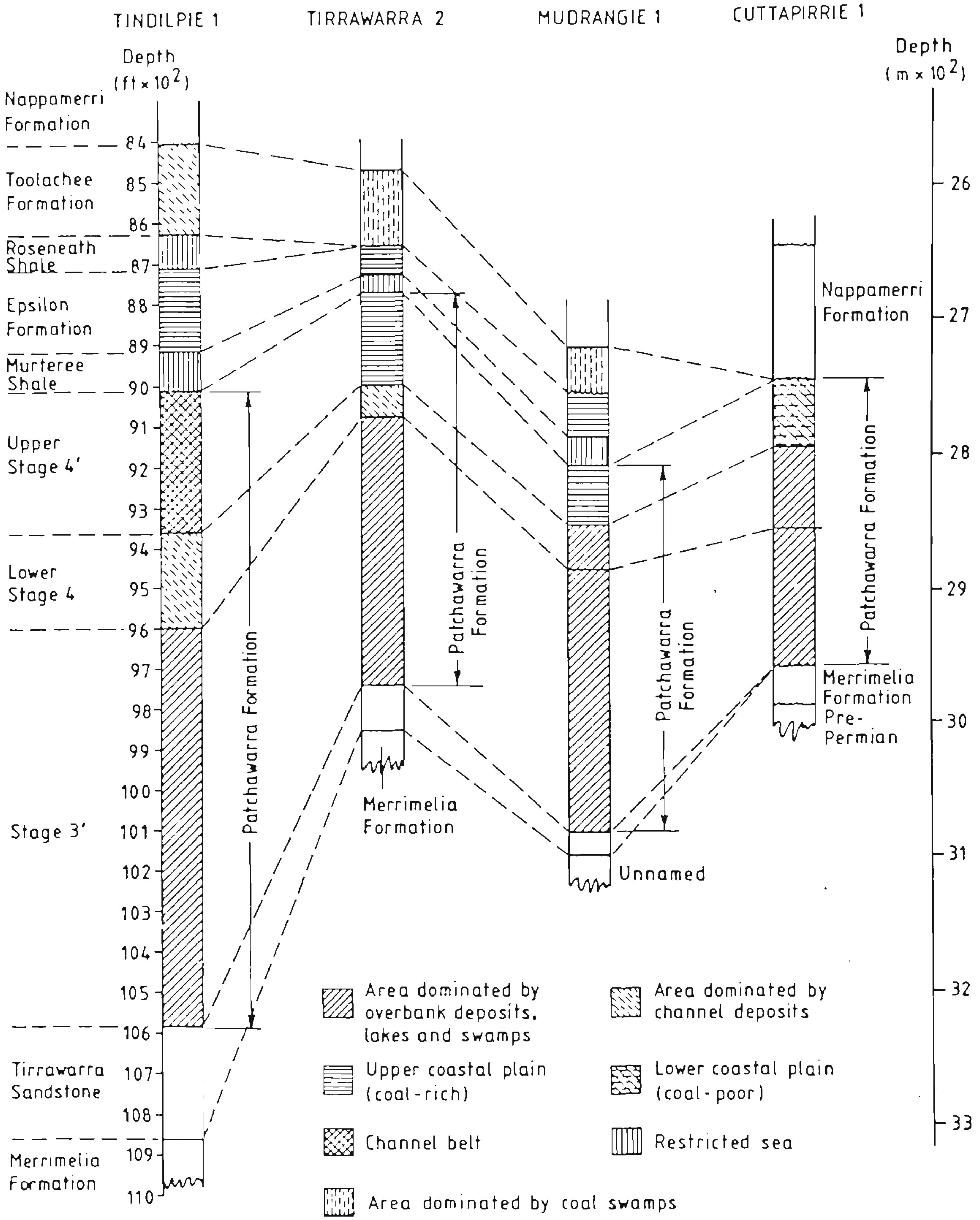


FIG 8.3 Formations and depositional environments proposed by Thornton (1979) for the four wells in the Patchawarra Trough.

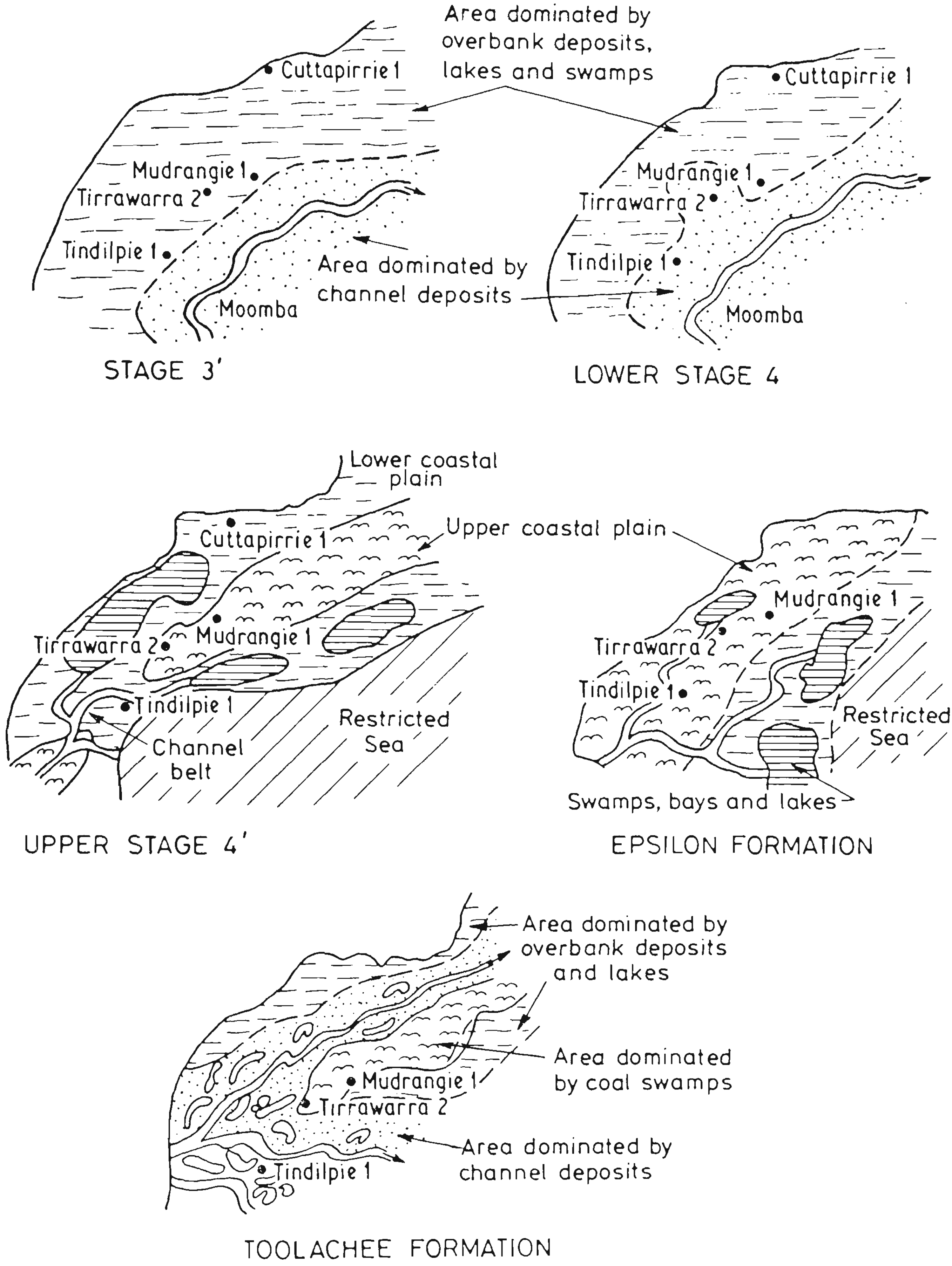
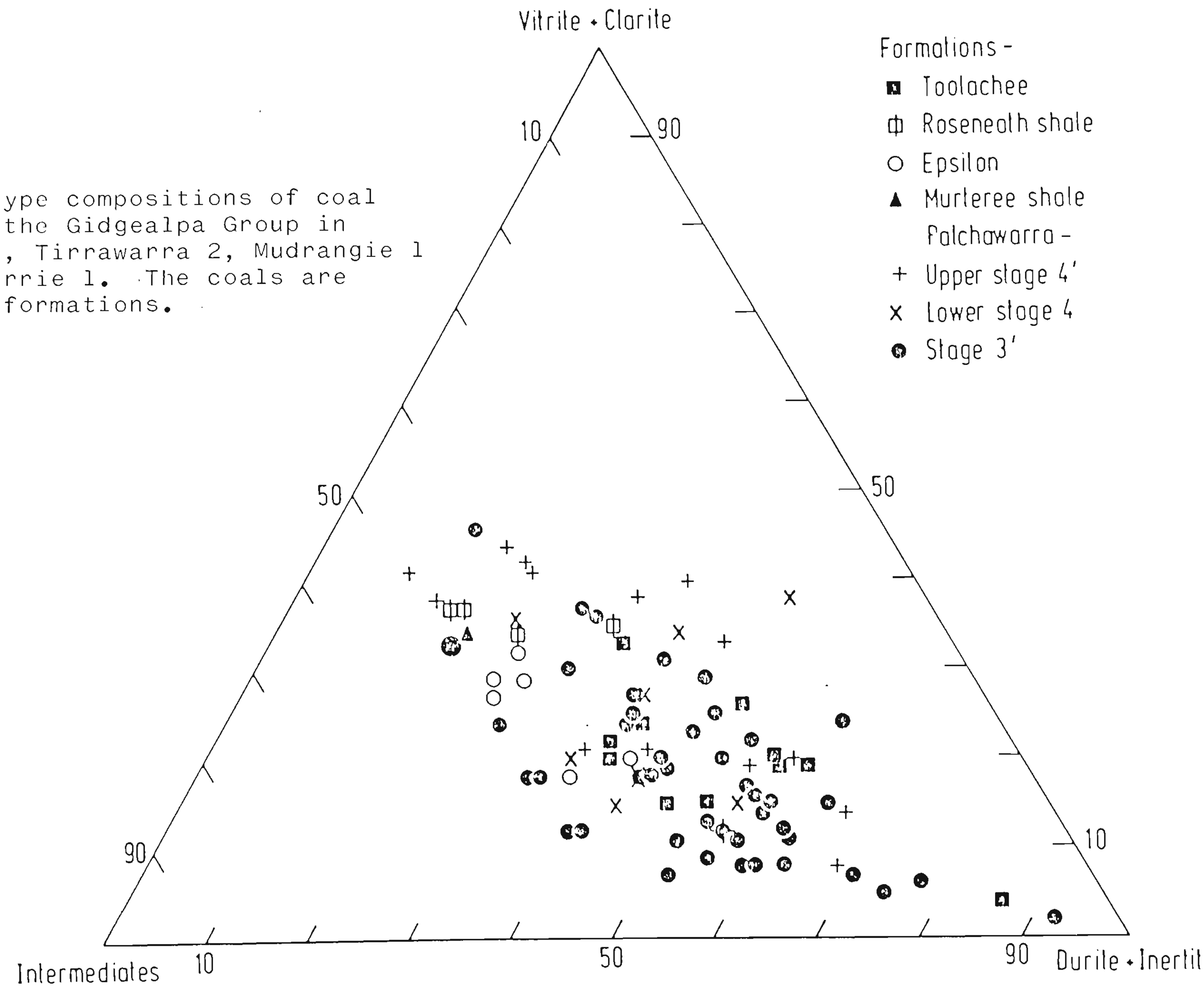


FIG. 8.4 Formations and depositional environment proposed by Thornton (1979) for the four wells in the Patchawarra Trough.

FIG. 8.5.

Microlithotype compositions of coal seams from the Gidgealpa Group in Tindilpie 1, Tirrawarra 2, Mudrangie 1 and Cuttapirrie 1. The coals are grouped in formations.



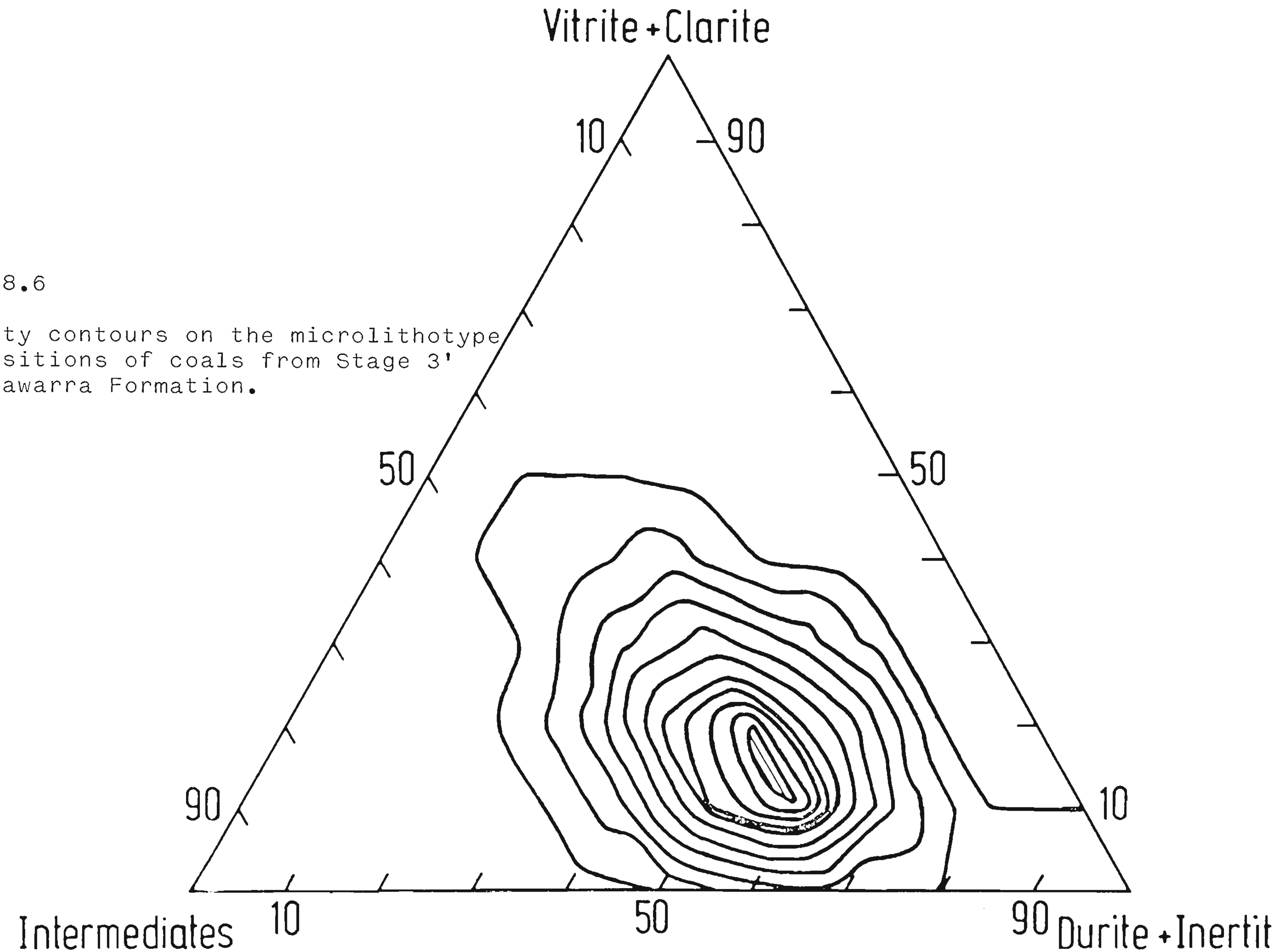


FIG. 8.6

Density contours on the microlithotype compositions of coals from Stage 3' Patchawarra Formation.

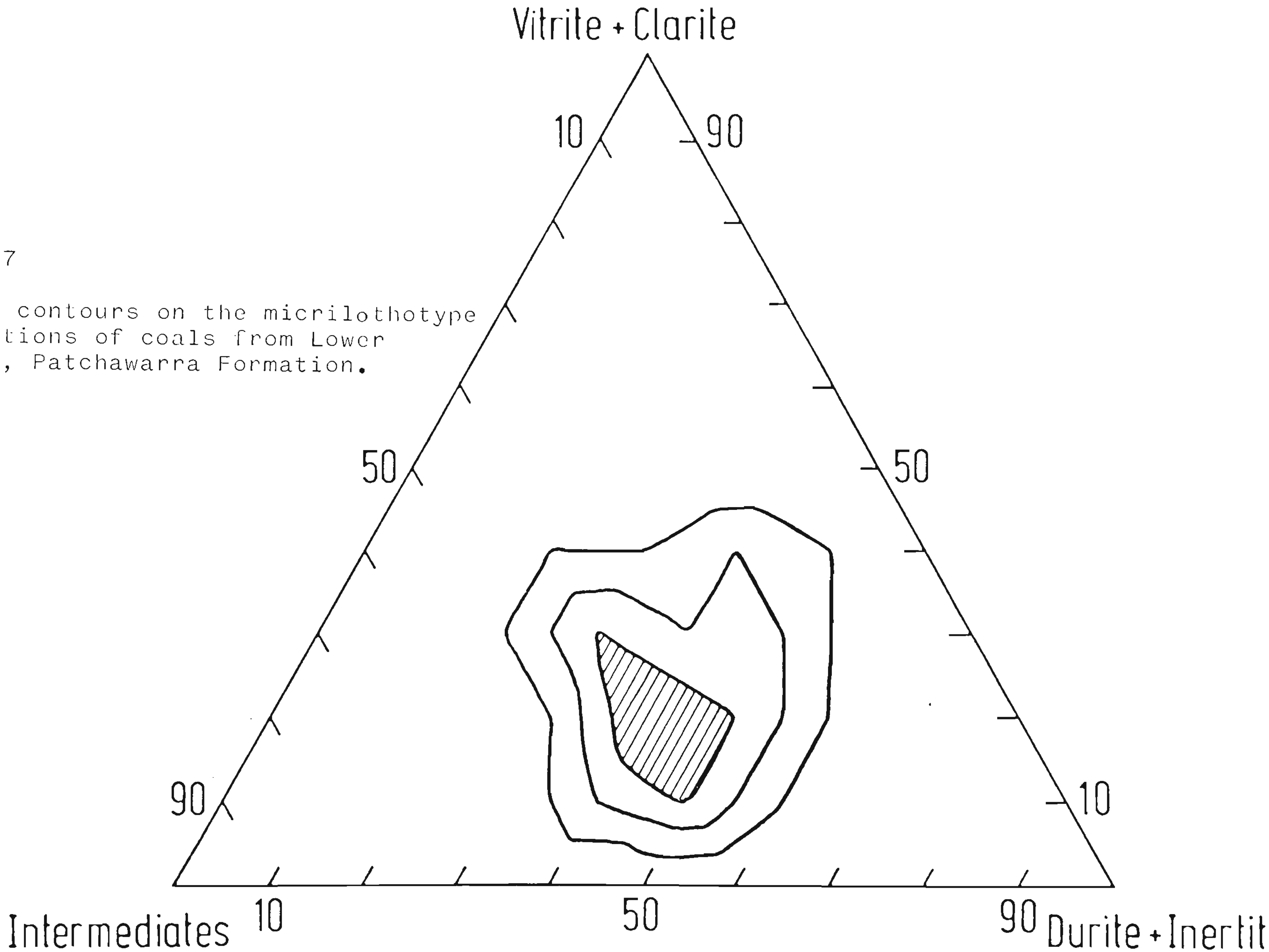


FIG. 8.7

Density contours on the micrilothotype compositions of coals from Lower Stage 4, Patchawarra Formation.

FIG. 8.8

Density contours on microlithotype compositions of coals from Upper Stage 4', Patchawarra Formation.

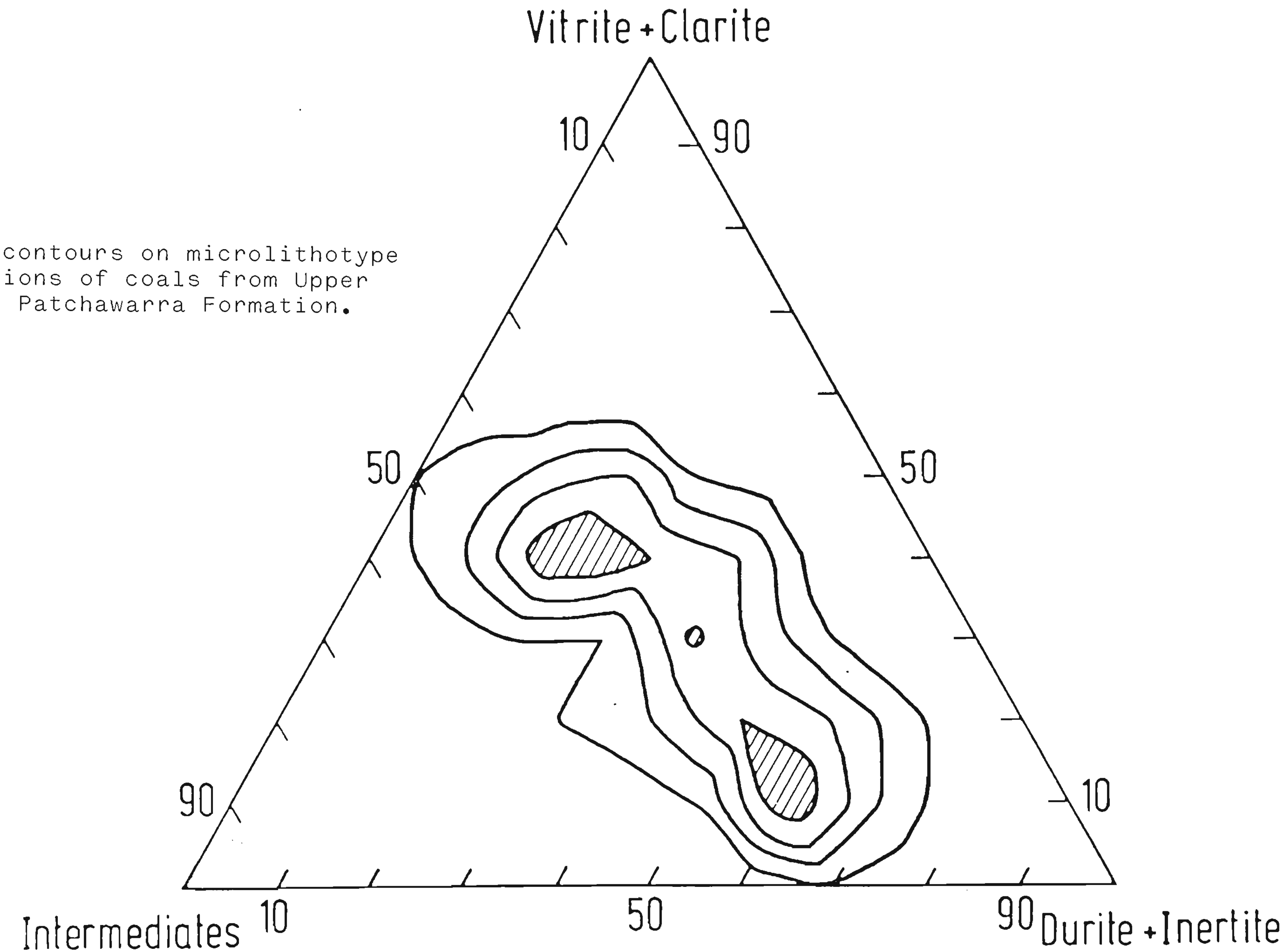


FIG. 8.9

Density contour on microlithotype compositions of coals from Roseneath and Murteree (▲) Shales

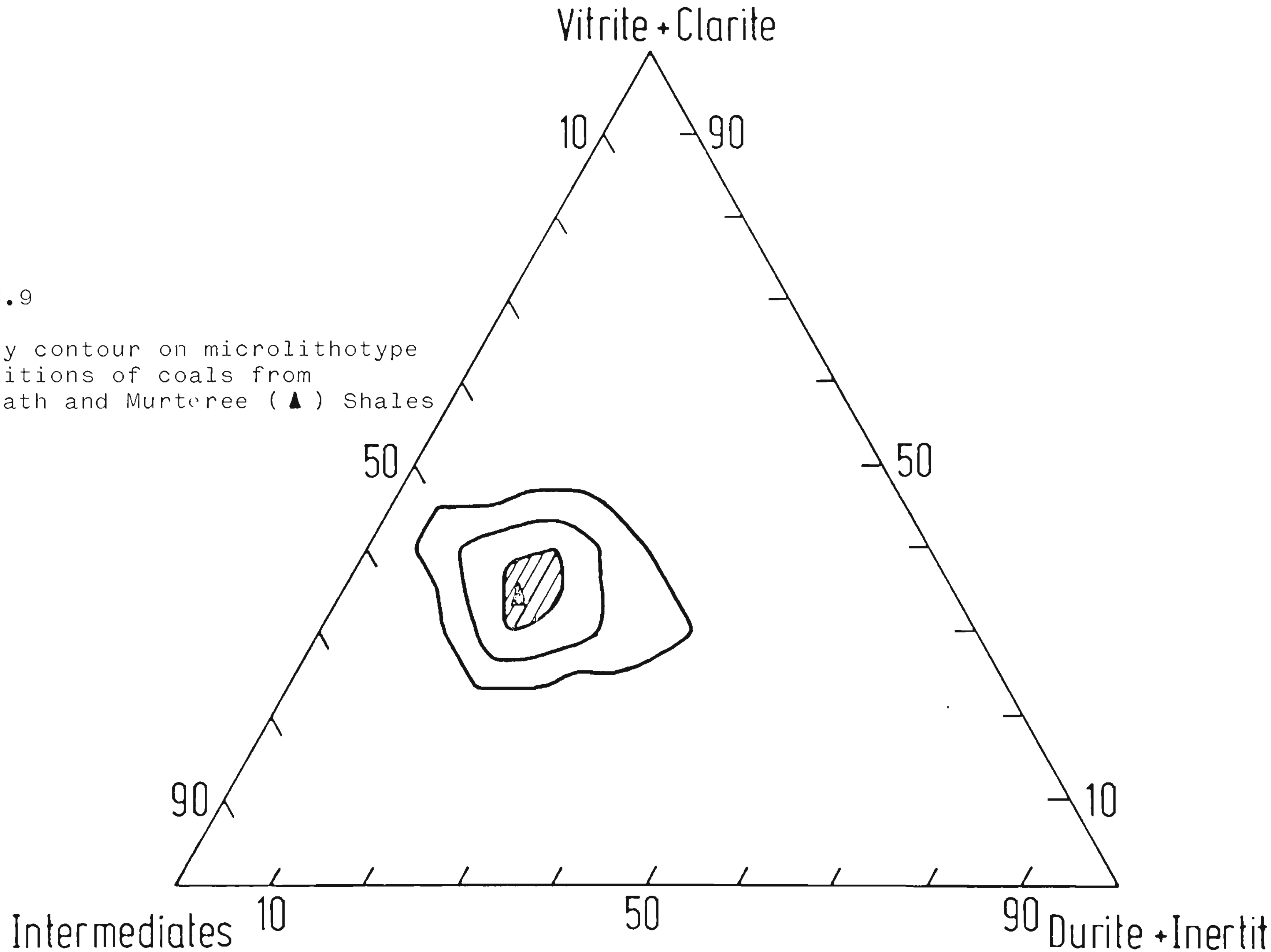


FIG. 8.10

Density contours on microlithotype compositions of coals from the Epsilon Formation.

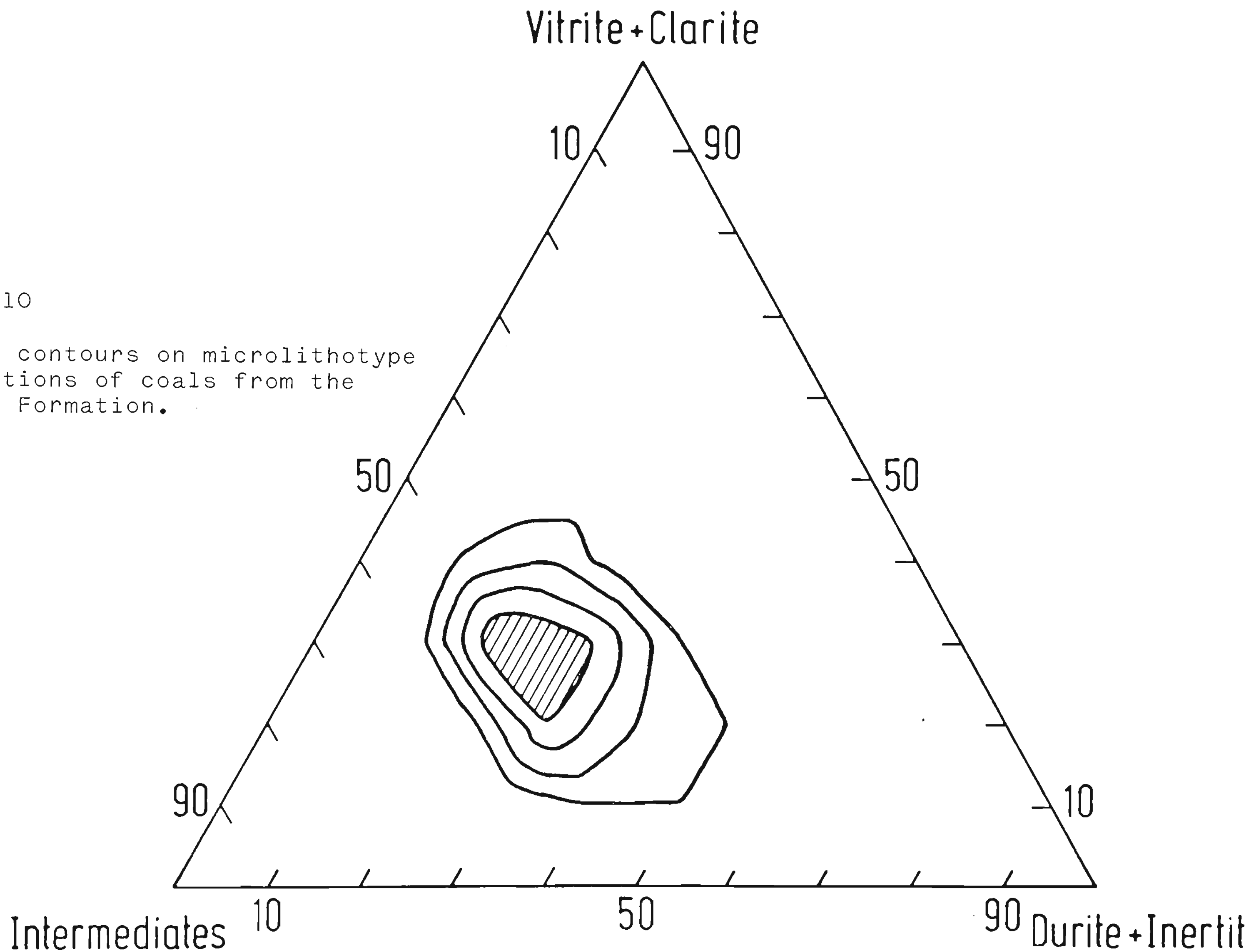


FIG. 8.11

Density contours on microlithotype compositions of coals from the Toolachee Formation.

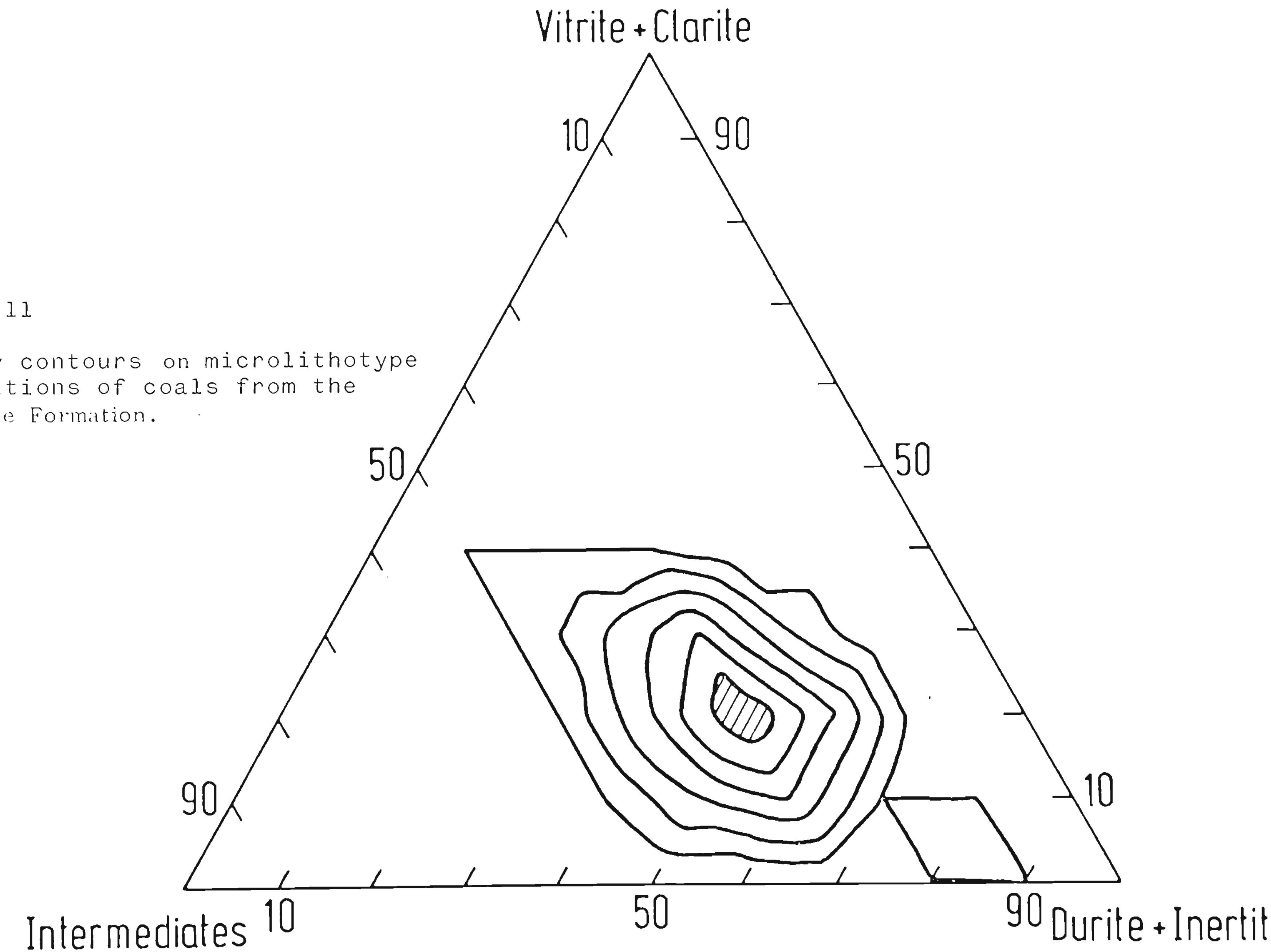
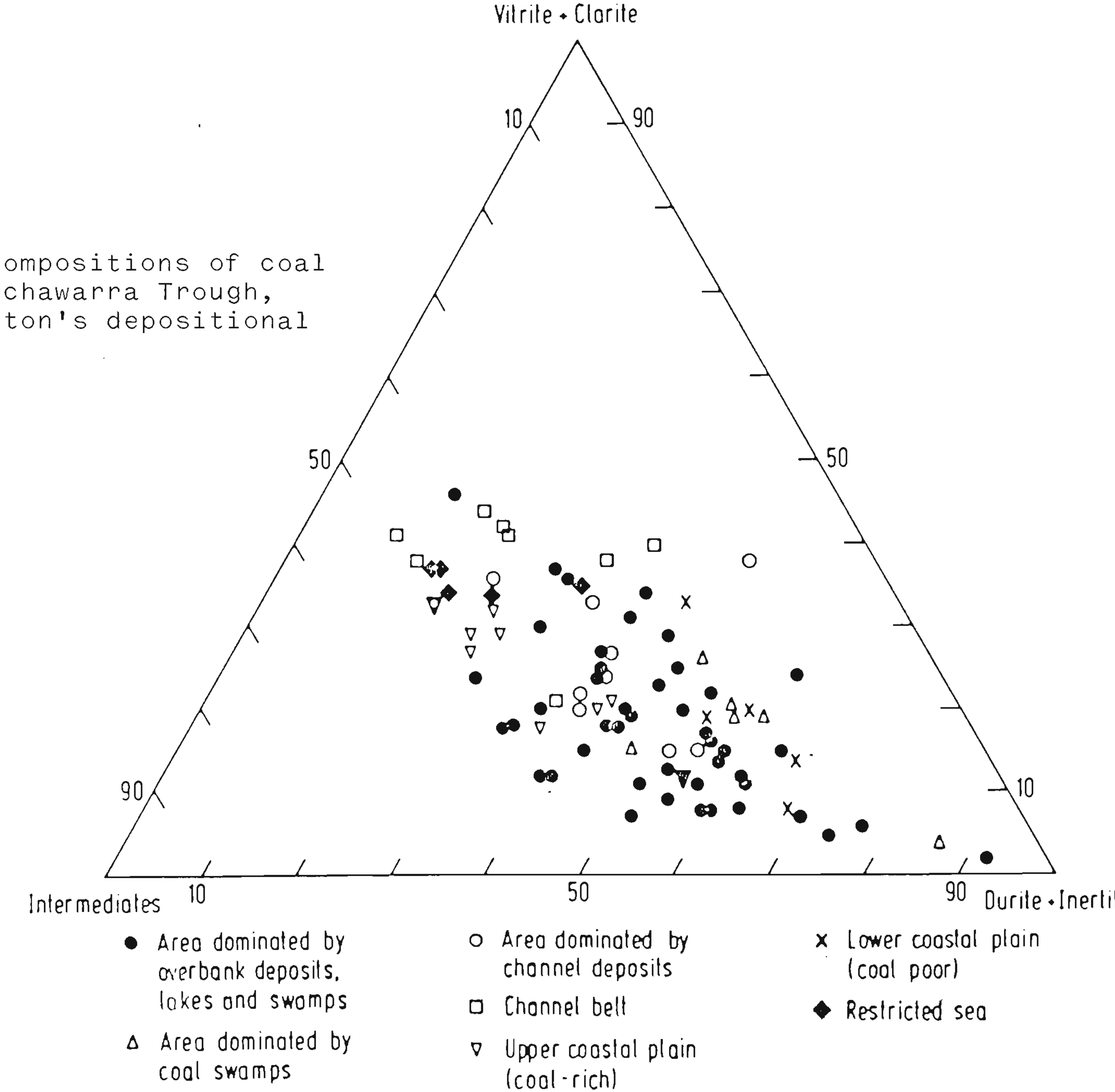


FIG. 8.12

Microlithotype compositions of coal seams in the Patchawarra Trough, grouped by Thornton's depositional environments.



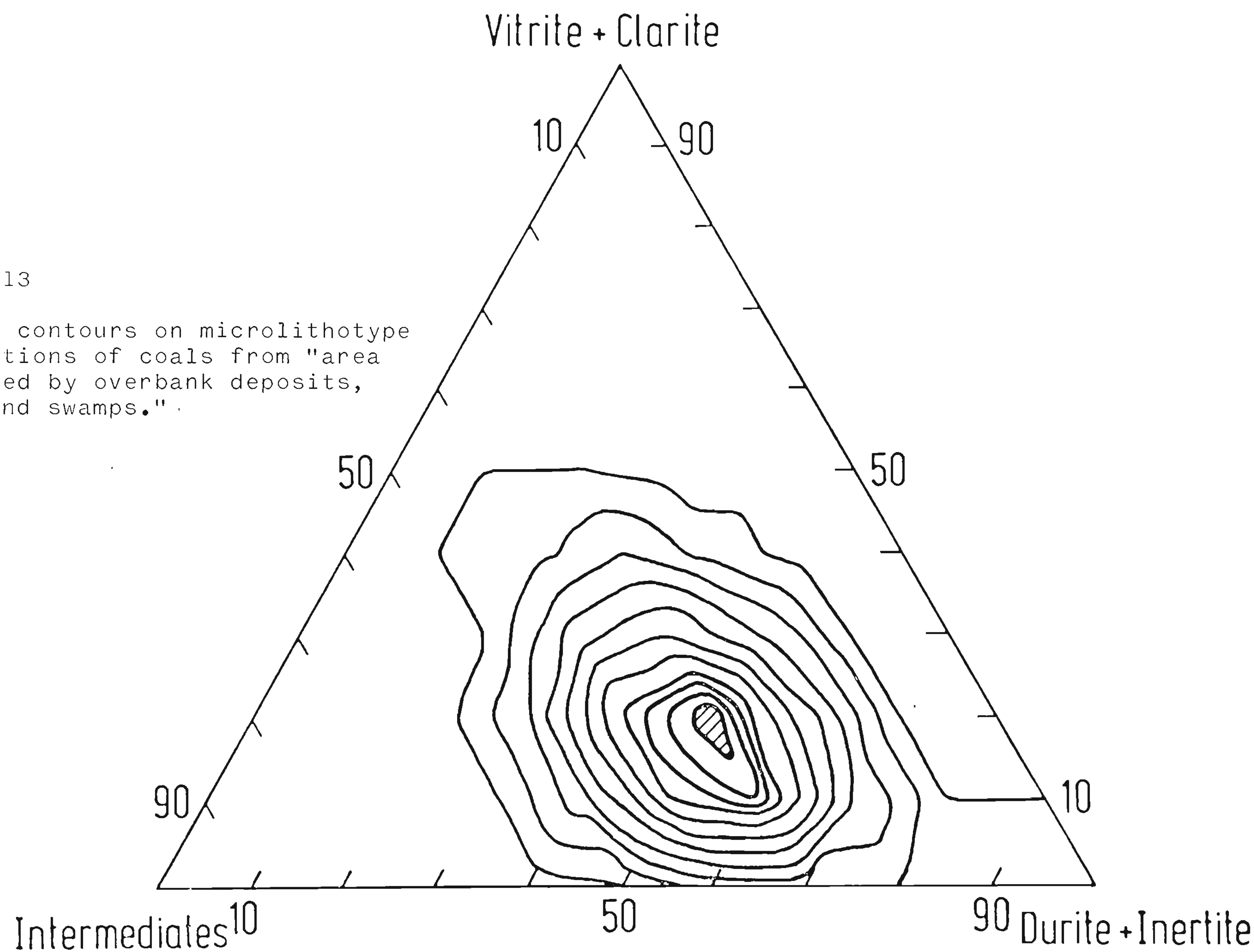
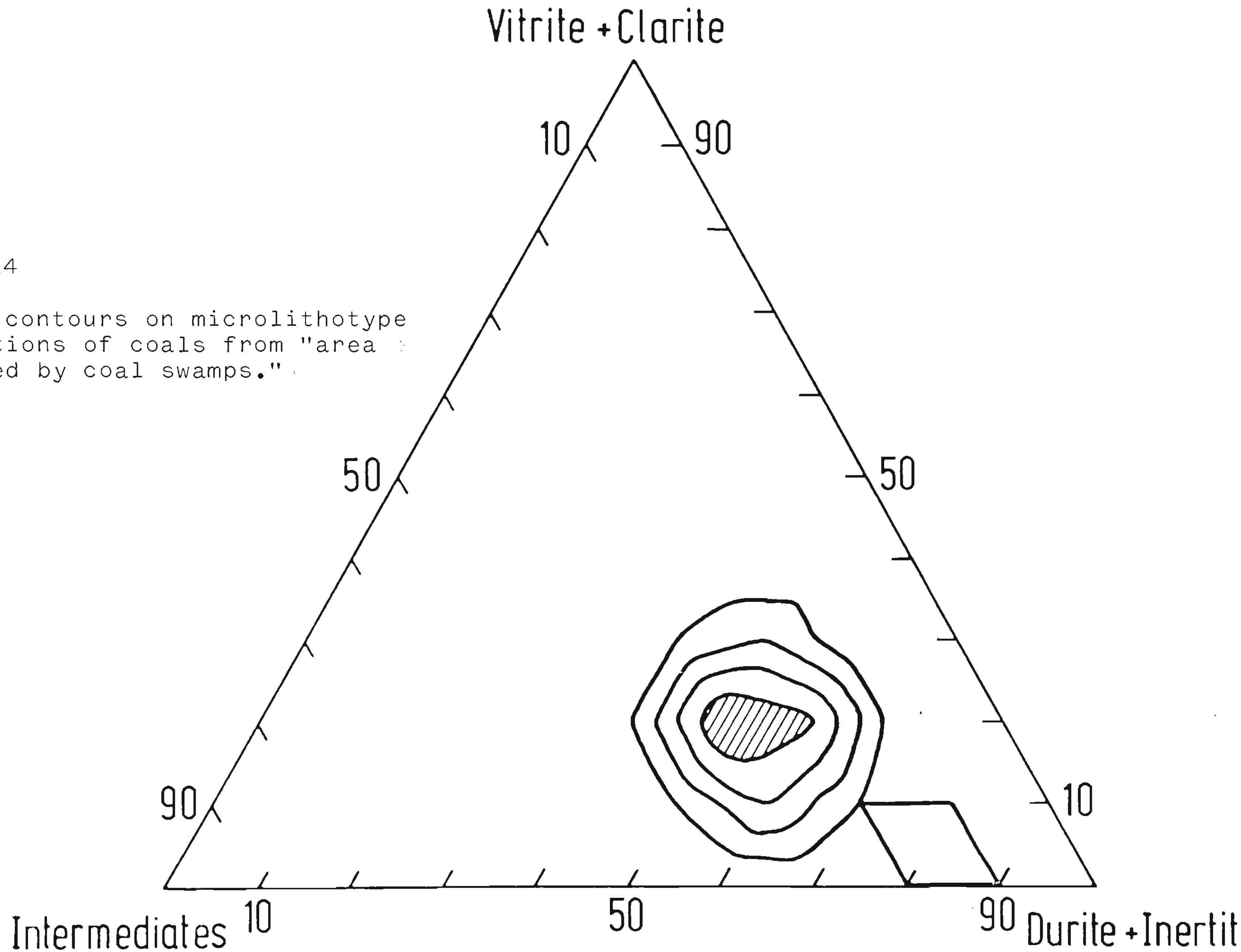


FIG. 8.13

Density contours on microlithotype compositions of coals from "area dominated by overbank deposits, lakes and swamps."

FIG. 8.14

Density contours on microlithotype compositions of coals from "area dominated by coal swamps."



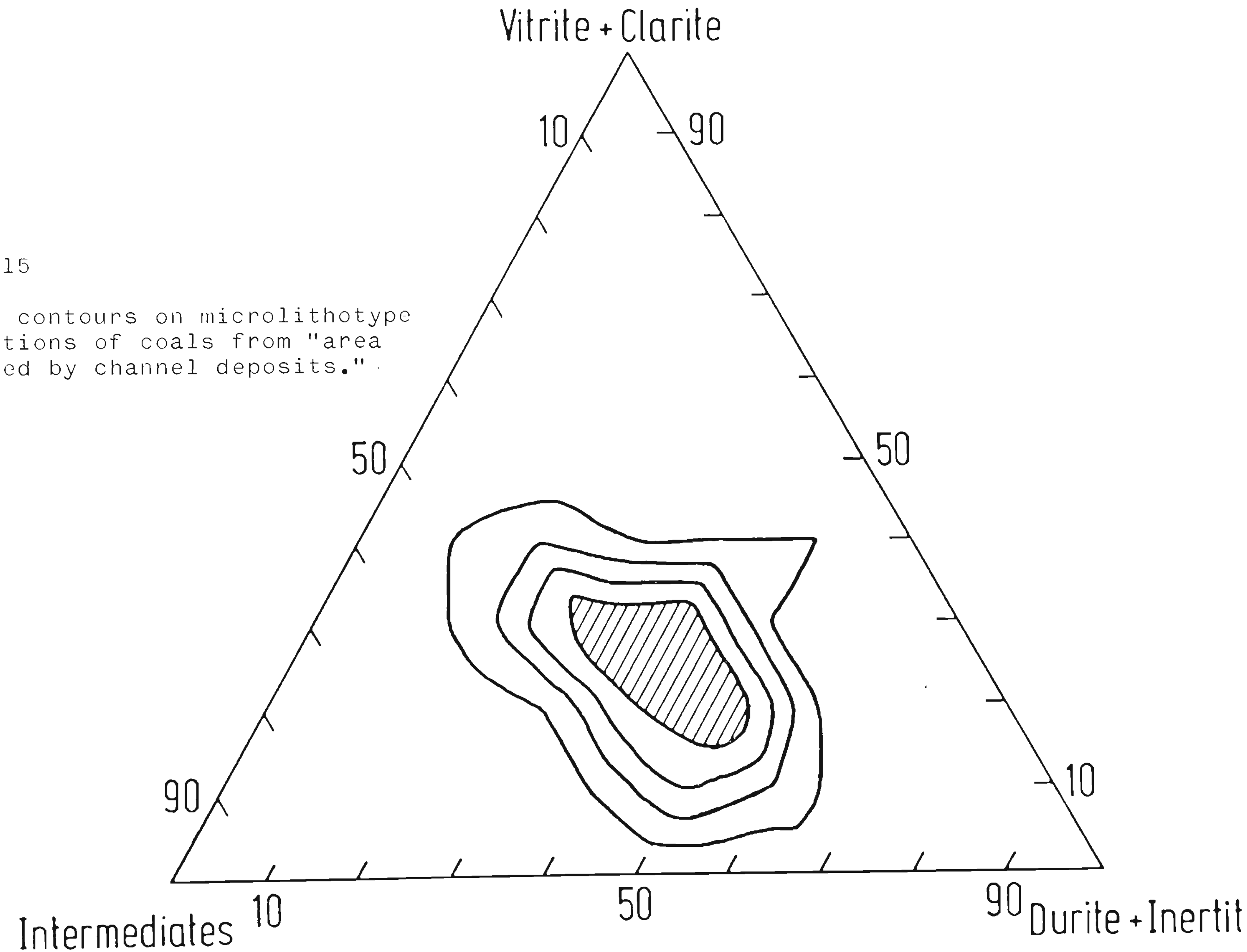
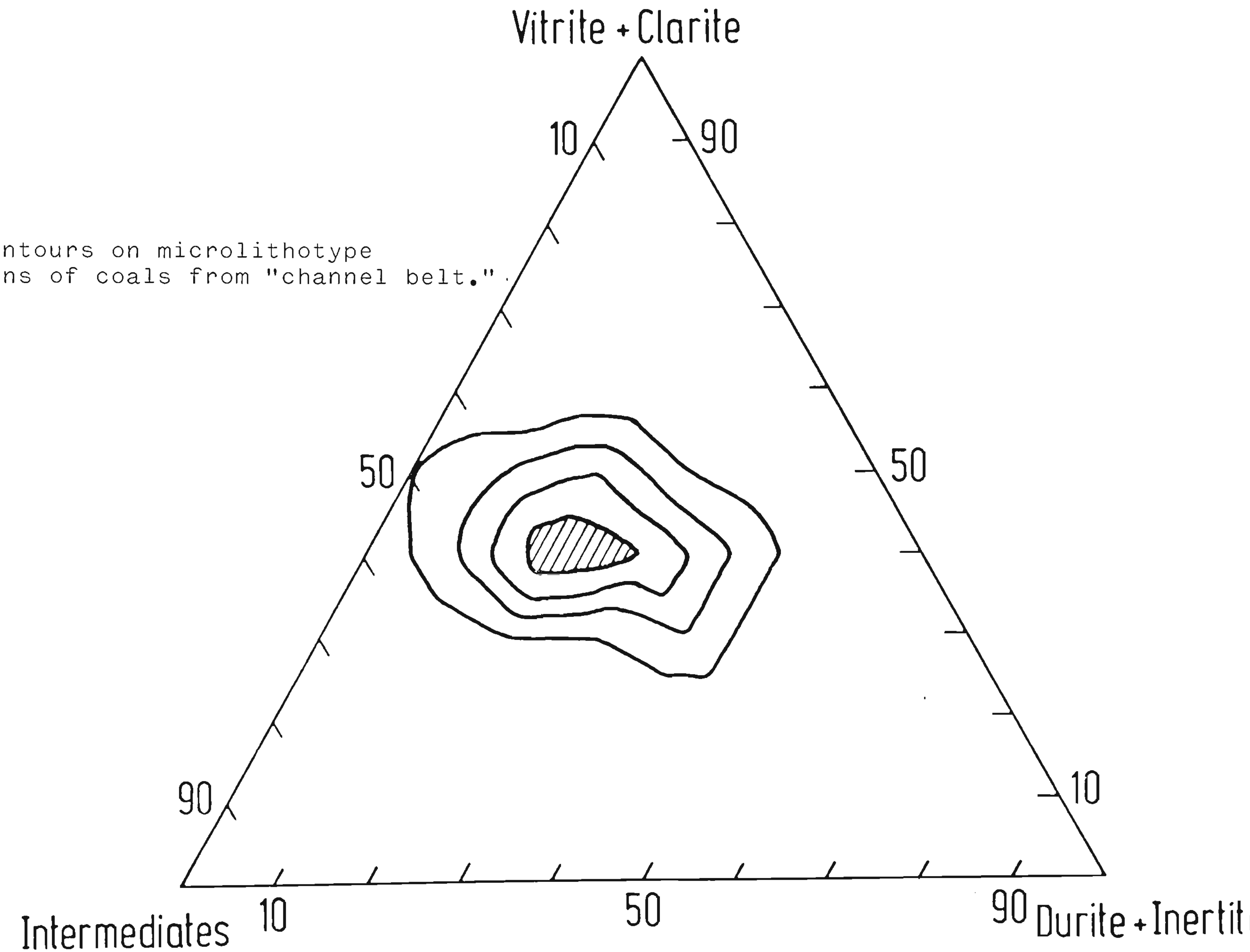


FIG. 8.15

Density contours on microlithotype compositions of coals from "area dominated by channel deposits."

FIG. 8.16

Density contours on microlithotype compositions of coals from "channel belt."



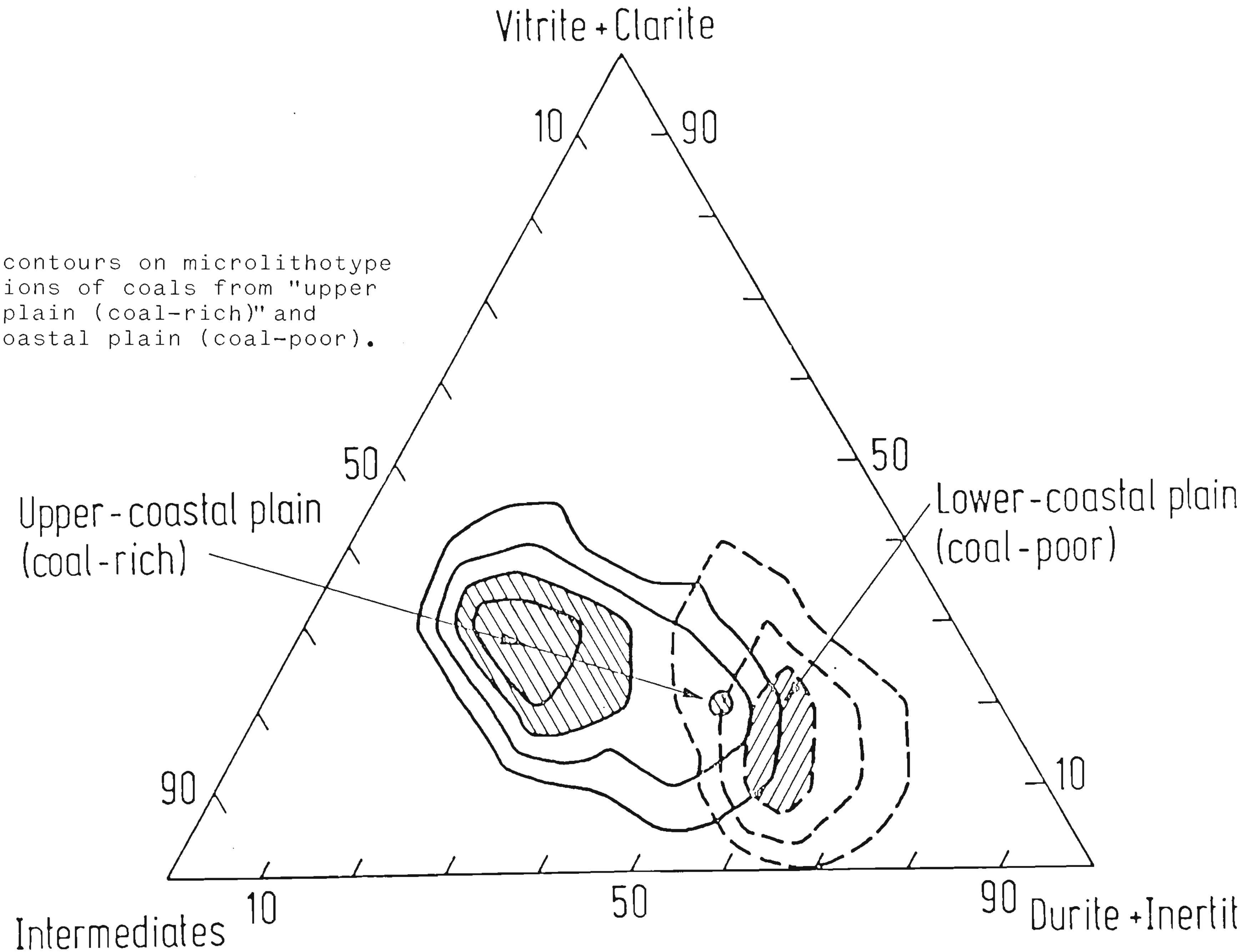
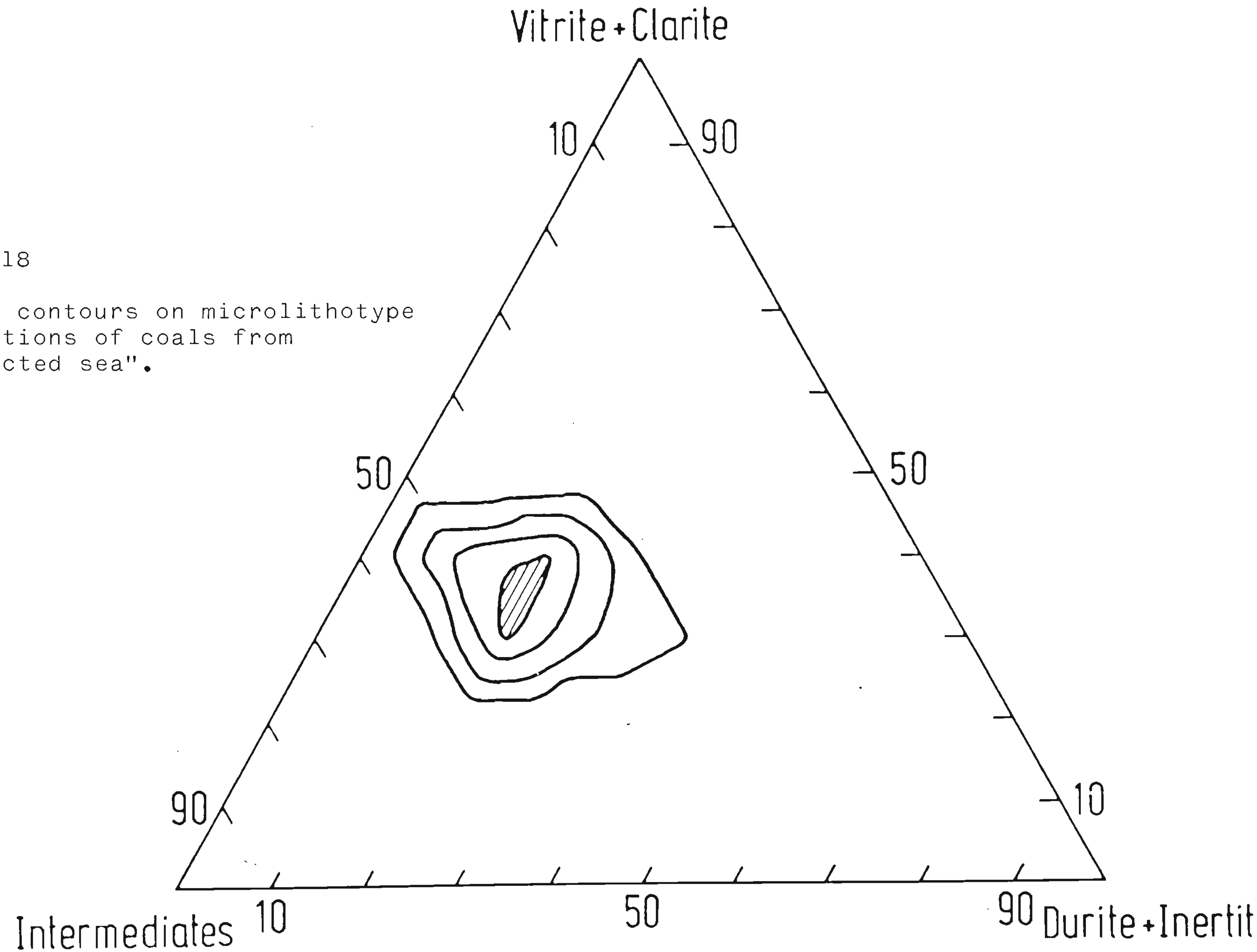


FIG.8.17

Density contours on microlithotype compositions of coals from "upper coastal plain (coal-rich)" and "lower coastal plain (coal-poor).

FIG. 8.18

Density contours on microlithotype compositions of coals from "restricted sea".



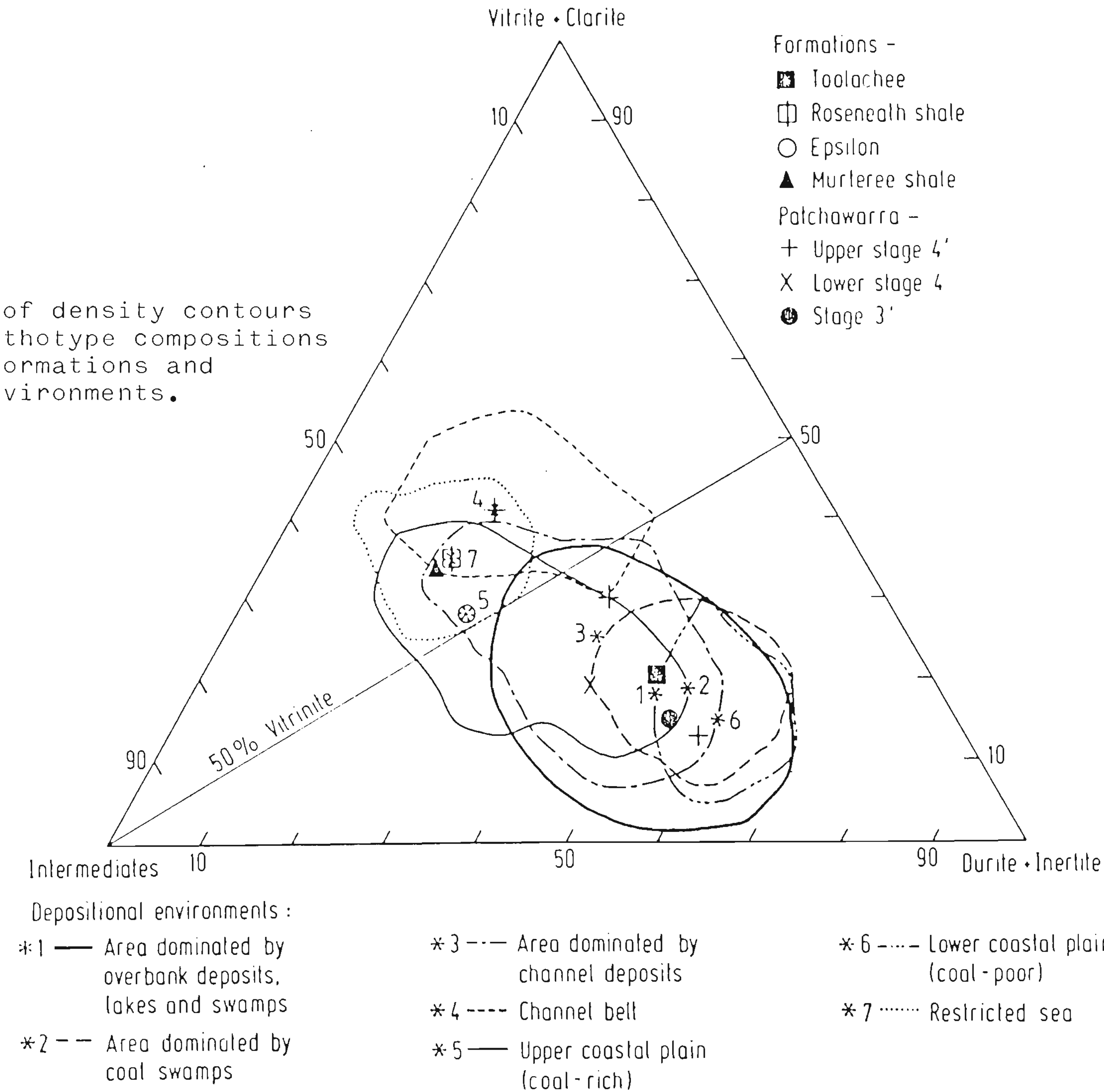


FIG. 8.19

Central points of density contours of coal microlithotype compositions based on both formations and depositional environments.

9. DISCUSSION

9 (i) Macerals

The first aim of this study was to determine whether any relationship exists between coal macerals and DOM macerals in associated sediments.

Correlations, significant at the 5% level, have been found between the macerals of coals and DOM in the Permian Patchawarra Formation of the Cooper Basin, the Permian Purni Formation of the Pedirka Basin, the Triassic Peera Peera Formation of the Simpson Desert Basin and the Jurassic Poolowanna Formation of the Eromanga Basin. These correlations are presented in Tables 9.1 to 9.3 for vitrinite DOM, exinite DOM and inertinite DOM, respectively.

Significant correlations have been found between vitrinite DOM in the Cooper, Pedirka and Eromanga Basins and

vitrinite in coal (Cooper Basin)

exinite in coal (Eromanga Basin)

and negatively,

exinite in coal (Pedirka Basin) (Table 9.1)

The results involving vitrinite DOM and exinite in coal are different for the Pedirka and Eromanga Basins.

In Table 9.2, exinite DOM correlates with

vitrinite in coal (Cooper and Eromanga Basins)

exinite in coal (Cooper and Eromanga Basins)

and negatively with

inertinite in coal (Cooper Basin)

exinite in coal (Simpson Desert Basin).

Results involving exinite in coal for the Cooper and Eromanga Basins are different again from those for the sequences in the Simpson Desert Basin.

The inertinite DOM correlations are given in Table 9.3 Inertinite DOM correlates with

inertinite in coal (Cooper Basin)

and negatively with

vitrinite in coal (Cooper Basin)

exinite in coal (Cooper and Eromanga Basins).

Each DOM maceral correlates with the same maceral in the coal in the Cooper Basin. This is not true for exinite in the Simpson Desert Basin. Results for the Cooper and Eromanga Basins are in agreement, and, in part, contradictory to those for the Pedirka and Simpson Desert Basins.

9(ii) Agreement and Disagreement

Exinite is the maceral involved in the contradictory results. Sporinite is the dominant exinite in coals and DOM of the Patchawarra Formation, Cooper Basin (Fig.4.26); the exinite in Pedirka Basin, Purni Formation coals occurs as approximately equal proportions of cutinite and sporinite (Fig.6.11); in the Simpson Desert Basin, Peera Peera Formation exinite DOM is predominantly cutinite, and cutinite forms about 50% of the exinite in the coals (Fig.6.11); cutinite is the least abundant exinite in the Poolowanna Formation of the Eromanga Basin, sporinite and resinite are dominant, resinite higher in coals, sporinite higher in DOM (Fig.7.6).

Similar relationships occur between the macerals in coals and DOM of the Cooper and Eromanga Basins, where the exinite is largely sporinite, whereas the predominantly cutinite exinite of the Pedirka and Simpson Desert Basins is associated with the reverse relationships.

The positive correlation between sporinite DOM and sporinite in coal implies a high degree of mobility of the spores, so that they were distributed widely in both peat swamps and adjacent sediments. This is in keeping with the nature of spores, which are intended to escape from the plants producing them. Spores are selectively dispersed by wind and water.

Cuticle, on the other hand, is intimately attached to needles, shoots, stalks, leaves, roots and thin stems which it covers. It is, in most cases, associated with vitrinite. The more cutinite in Pedirka Basin coals, the less vitrinite DOM in associated sediments. Possibly the conditions which keep the cutinite within the peat swamp, such as still water, retained the vitrinite precursors.
In the Simpson Desert Basin, the more cutinite in coal, the less cutinite DOM. Cutinite is bound into the peat, and little escapes into adjacent sediments. That is, cutinite is preferentially retained in the coal-forming areas.

Macerals vitrinite and exinite are linked, and are correlated negatively with inertinite. Inertinite DOM increases with an increase in inertinite in associated coal, and decreases with an increase in vitrinite and exinite in associated coal in the Cooper and Eromanga Basins. Inertodetrinite is the dominant inertinite in both coals and DOM in the Cooper Basin (Fig.4.29) and in the DOM of the Eromanga Basin (Fig.7.9). Semifusinite is more abundant in the Eromanga Basin coals. The relationship for inertinite between coals and DOM indicates that it, too, is easily moved around the peat swamp and into the adjacent sediments. Any semifusinite drifting away from the peat is likely to be broken up into inertodetrinite DOM.

In summary, the relationships between macerals in DOM and associated coals are:
Vitrinite DOM correlates with vitrinite in coal (Cooper Basin) and resinite in coal (Eromanga Basin) and is negatively associated with

cutinite in coal (Pedirka Basin).

Exinite DOM, occurring as sporinite, correlates with vitrinite and sporinite in coal (Cooper and Eromanga Basins); and occurring as cutinite correlates negatively with cutinite in the coal (Simpson Desert Basin). Sporinite DOM correlates negatively with inertinite in coal (Cooper Basin).

Inertinite DOM, predominantly inertodetrinite, correlates with inertodetrinite in coal (Cooper Basin) and correlates negatively with vitrinite and sporinite in coal (Cooper Basin).

9(iii) DOM macerals and coal microlithotypes

The second aim of this study was to determine any relations between coal microlithotypes and dispersed organic matter macerals in associated sediments.

Vitrinite DOM correlates with

intermediates (Cooper Basin)

and negatively with

durite plus inertite (Cooper Basin) (Table 9.1)

Exinite DOM correlates with

vitrite plus clarite (Cooper Basin)

intermediates (Cooper Basin)

and negatively with

durite plus inertite (Cooper Basin) (Table 9.2)

Inertinite DOM correlates with

durite plus inertite (Cooper Basin)

and negatively with

vitrite plus clarite (Cooper Basin)

intermediates (Cooper Basin) (Table 9.3)

Unfortunately, significant results involving microlithotypes are available only from the Patchawarra Formation of the Cooper Basin. Vitrite plus clarite correlate with exinite DOM, and negatively with inertinite DOM; intermediates correlate with vitrinite DOM and exinite DOM, and negatively with inertinite DOM; and durite plus inertite correlate with inertinite DOM and negatively with vitrinite DOM and exinite DOM.

The sediment intervals which are most likely to contain exinite DOM are those associated with coals having the greatest vitrite plus clarite and intermediates contents; vitrinite DOM is most likely to be in intervals associated with intermediates - rich coals; and inertinite DOM is likely to be in sediments associated with durite plus inertite-rich coals. The occurrence of the latter coals is also likely to exclude the occurrence of vitrinite and exinite DOM in the associated sediments.

9(iv) Location of Hydrocarbon Source Rocks

The third aim of this study was to determine the locations of good source rocks for hydrocarbons in the Cooper, Pedirka, Simpson Desert and Eromanga Basin.

The quantity of DOM in sediments is first considered. Ronov, (1958), having investigated 26,000 samples, found the critical lower limit for non-reservoir rock, shale-type source sediments in oil provinces to be 0.5% organic carbon. This lower limit of 0.5% organic carbon has been confirmed by more recent findings from generally acknowledged source rock units (Tissot and Welte, 1978, p.430). The organic carbon may be exinite and/or vitrinite only, or may also include inertinite. In all cases, an organic carbon content of 0.5% is presumed necessary for a rock to be a source rock.

Minimum values are significant because a critical level of hydrocarbons must be reached before expulsion from a source rock is possible. "Prior to expulsion, the specific adsorption capacity of a source rock for hydrocarbons has to be satisfied and, moreover, sufficient hydrocarbons for movement of a pressure-driven hydrocarbon phase have to be available" (Tissot and Welte, 1978, pp.430-431). Specific hydrocarbon yields certainly vary with maceral type and it is probable that the threshold is relatively sensitive to maceral composition.

On the basis of the weight of total organic carbon, Thomas (1979) rated the hydrocarbon source potential of rocks as:

0 - 0.5% poor

0.5 - 1.0% fair

1.0 - 2.0% good

2% excellent

All the results of the petrographic studies are expressed in percentages by volume. The density of coal is approximately 1.3, that of clay, quartz is 2.6. Thus, the volume of organic matter must be about twice the values in the above table for the same ratings. Also, as all of the organic matter is not carbon, a correction must be made for this to allow volume to be equated with organic carbon. Most of the organic matter studied has a carbon content between 80 and 90%. On the basis of organic matter by volume, the hydrocarbon source rock ratings are:

$$\frac{2\ (\text{organic carbon}) \times 100}{80} \quad (\text{worst case})$$

which gives

0 - 1.3% poor

1.3 - 2.5% fair   for DOM by volume

2.5 - 5% good

5% excellent

If the above values include all organic matter, i.e. exinite, vitrinite and inertinite, then the formations studied have potential as hydrocarbon source rocks as shown in Table 9.4. On this basis, the formations which are rated good to excellent source rocks are the upper part of the Peera Peera Formation of the Simpson Desert Basin, and the Patchawarra, Murteree and Epsilon Formations of the Cooper Basin. This is consistent with the status of the Cooper Basin as a producing oil and gas field, and the discovery of hydrocarbons above the Peera Peera Formation.

The type of DOM in sediments is next considered. If only exinite DOM and vitrinite DOM are allowed as potential source material for hydrocarbons the ratings of the formations would be as shown in the second ratings column of Table 9.4 (p.289). Most formations would be rated as poor, which is not consistent with the status of the Cooper Basin.

If inertinite is to be excluded as a source of hydrocarbons, then either the quantity of DOM needed to produce hydrocarbons is much lower than the 0.5% organic carbon generally accepted, or, other organic matter such as coal seams, must also generate hydrocarbons.

Coal is discounted as a hydrocarbon source by most authors (Tissot and Welte, 1978; Evans et al., 1984) because any hydrocarbons generated are considered by them to be held in the coal on account of its high sorptive capacity. Cook (1982b)on the other hand, believes that coals do generate and release oil. Durand and Paratte (1983) consider coals to be sources of oil, and that oil is more easily expelled from coals than from other source rocks.

If coal is considered to be a source for hydrocarbons, for example, in the Cooper Basin, the potential of the formations of the Gidgealpa Group are as shown in Table 9.5. If all of the coal is a source, then the potential of all formations is excellent. If only the exinite in the coals is allowed as a source for oil, then all formations rate as poor to fair. The potential of the rocks to generate oil if exinites from both coals and DOM are taken into account is fair for the Toolachee, Epsilon and Patchawarra, cycle 3, Formations. All other formations have a poor potential. If both exinite and vitrinite in the coal are considered as sources for hydrocarbons, oil and gas, then the rocks in the Gidgealpa Group have excellent potential, even without including the contribution from DOM.

The Tertiary Frio Formation in the Texas Gulf coastal plain has yielded nearly 6 billion barrels of oil and 60 trillion cubic feet of gas (Galloway et al., 1982). Total organic carbon data for 140 Frio samples average slightly below 0.3 wt% organic carbon. Few samples exceeded 0.4%.

Herbaceous and woody organic matter dominate in the Frio, with relatively small quantities of amorphous organic matter.

Smith and Cook (1980), investigating coals of Carboniferous to Tertiary age from the U.K., U.S.A., Canada and Australia, found that over the rank range 0.2-0.6% $\bar{R}_v$ max (average maximum vitrinite reflectance) rapid inertinite coalification occurs, with R_I max (Average maximum inertinite reflectance) increasing from 0.7 to 1.65%.

Widely accepted geochemical data on petroleum source rocks include the propositions that

i) the quantity of total organic carbon in a rock must be 0.5% or more;

ii) the dispersed organic matter in the rock generates oil only from exinite, and possibly some vitrinite;

iii) any hydrocarbons generated in coal are held in the coal mono-structure, so coal is not a source.

Clearly, the organic matter in the Patchawarra Trough does not meet these specifications. Its status as a producing oilfield shows that at least one, if not all three, of the above conditions is not necessarily applicable for a rock to be a source for hydrocarbons (Smyth, 1983).

The <u>rank of DOM</u> in sediments is the third property to be taken into consideration when assessing the potential of a rock as a source of hydrocarbons. The Permian Gidgealpa Group is oil mature to post-mature over almost the entire Cooper Basin (Kantsler et al., 1983). Therefore, only quantity and type of DOM need be assessed for source rock potential in the Patchawarra Trough sediments.

On the basis of quantity, the Patchawarra, Murteree and Epsilon Formations are the most suitable. In Tindilpie 1 the Murteree has a comparatively high exinite content (16%, Table 9.4), though it is low in

Mudrangie (5%). Cycle 3 of the Patchawarra Formation in Tindilpie 1 also has a comparatively high exinite content (11%). In absolute terms though, the volume of exinite is, at most, 0.6%, so it is necessary to accept a lower limit for the quantity of DOM required in a source rock, or to include vitrinite and/or inertinite and/or coals in the generative material.

In Macumba 1 the Algebuckina, Poolowanna and Peera Peera Formations are rated as having a fair generative potential on the basis of the volume of DOM present. Cook (1982b) writes that for the Poolowanna Formation "In the central part of the Simpson Desert Basin generation from all the macerals is likely to have occurred but in most other areas, only the vitrinite, resinite and suberinite are likely to have generated hydrocarbons". He puts the initial generation rank of inertinite at a vitrinite reflectance value of 0.4%; that of vitrinite at 0.45%; resinite 0.4 to 0.45%, and that of sporinite and cutinite at 0.6%. The Algebuckina Formation may in some areas be sufficiently mature to generate hydrocarbons. The Peera Peera Formation is sufficiently mature. Again, on the basis of quantity, the same provisions apply as for the Cooper Basin sediments.

9(v) Coal microlithotypes and depositional environments in the Cooper Basin

The fourth aim of this study was to determine the usefulness of coal microlithotypes as indicators of depositional environments in the Cooper Basin.

The microlithotype compositions of coals occurring in depositional environments interpreted by Thornton (1979) could be differentiated from one another in many cases. Coals which accumulated in association with large lakes can be distinguished, on the basis of their microlithotype compositions, from those of:

i) lower coastal plain

ii) area dominated by coal swamps

iii) area dominated by overbank deposits, lakes and swamps.

Channel belt coals can be distinguished from those of the:

i) lower coastal plain

ii) upper coastal plain (slight overlap)

iii) area dominated by overbank deposits, lakes and swamps.

Lower coastal plain coals can be differentiated from those of the upper coastal plain.

In terms of coal forming environments, little difference exists between "area dominated by coal swamps" and "area dominated by overbank deposits, lakes and swamps". These two environments have virtually the same concentration points (Table 8.6). Grouping the two together gives a centre point of 19-31-50.

The terms "upper coastal plain" and "lower coastal plain" seem to be more geographical than geological; the lower coastal plain coals have compositions similar to those in the area dominated by coal swamps.

In Fig. 8.19, the "channel belt" and "large lake" environments have the highest vitrite plus clarite contents. In Tindilpie 1 these are represented by Upper Stage 4' and the Murteree and Roseneath Shales respectively. From the correlation found between DOM macerals and coal microlithotypes exinite DOM should be associated with these coals. That is, the best type of DOM for hydrocarbon generation is associated with "channel belt" and "large lake" sediments. The channel belt and large lake environments also have the highest vitrinite contents, (both around 60%) calculated from vitrinite = vitrite plus clarite + $\frac{1}{2}$ intermediates (Smyth, 1974). The "upper coastal plain" coals also have relatively high vitrinite, at approximately 50%. This environment is represented by the

Epsilon Formation. (Exinite DOM correlates with vitrinite in coal.)

On the basis of quantity of DOM, the best source rocks were cyles 2 and 3 of the Patchawarra Formation and the Murteree and Epsilon Formations. If coal is allowed as a source, all formations of the Gidgealpa Group (excluding Tirrawarra Sandstone) have good to excellent potential, for exinite + vitrinite.

Vitrinite DOM and exinite DOM correlate with intermediates. The coals highest in intermediates are those of the upper coastal plain, or Epsilon Formation. Both types of DOM correlate negatively with durite plus inertite. Coals highest in durite plus inertite are "lower coastal plain" (Upper Stage 4' in Cuttapirrie 1) and "area dominated by coal swamps" Patchawarra Formation Stage 3', Lower Stage 4 and the Toolachee Formation. On the basis of volume, Stage 3' and lower Stage 4 have "fair to good" potential, the Toolachee, "fair to poor".

Because of the variety of depositional environments presented in each formation of the Gidgealpa Group, the source potential in any one formation depends on the palaeogeography of the area, not just the stratigraphic interval.

Table 9.1 Correlations for vitrinite DOM

Correlation	Coal macerals	Age	Basin	Coal microlithotypes
positive		Permian	Cooper	$\frac{\text{intermediates (cycle 3)}}{\text{durite plus inertite}}$
negative	$\frac{\text{exinite}}{\text{inertinite}}$	Permian	Pedirka	
		Correlations for vitrinite DOM/exinite DOM		
positive	exinite	Jurassic	Eromanga	
		Correlations for vitrinite DOM/inertinite DOM		
positive	$\frac{\text{vitrinite}}{\text{inertinite}}$	Permian	Cooper	Intermediates (cycle 3)
positive	vitrinite	Permian	Cooper	$\frac{\text{intermediates (cycle 3)}}{\text{durite plus inertite}}$
negative		Permian	Cooper	durite plus inertite (cycle 3)
negative	exinite	Permian	Pedirka	

Table 9.2 Correlations for exinite DOM

Correlation	Coal macerals	Age	Basin	Coal microlithotypes
positive	vitrinite	Permian	Cooper	
positive	exinite	Permian	Cooper	
negative	inertinite	Permian	Cooper	
positive	exinite / vitrinite	Permian	Cooper	
positive	vitrinite / inertinite	Permian	Cooper	
positive	exinite / inertinite	Permian	Cooper	
positive		Permian	Cooper	vitrite plus clarite
negative		Permian	Cooper	durite plus inertite
positive		Permian	Cooper	vitrite plus clarite / durite plus inertite
positive		Permian	Cooper	intermediates / durite plus inertite
positive		Permian	Cooper	intermediates (cycle 3)
positive		Permian	Cooper	intermediates (cycle 3) / durite plus inertite
negative	exinite / vitrinite	Triassic	Simpson Desert	
positive	vitrinite / exinite	Jurassic	Eromanga	

Table 9.2 (cont'd) Correlations for exinite DOM

Correlation	Coal macerals	Age	Basin	Coal Microlithotypes
positive	$\frac{\text{exinite}}{\text{inertinite}}$	Jurassic	Eromanga	
		Correlations for exinite DOM/vitrinite DOM		
positive	vitrinite	Permian	Cooper	
positive	exinite	Permian	Cooper	
negative	inertinite	Permian	Cooper	
positive	exinite/vitrinite	Permian	Cooper	vitrite plus clarite
negative		Permian	Cooper	durite plus inertite
positive	vitrinite/inertinite	Permian	Cooper	$\frac{\text{vitrite plus clarite}}{\text{durite plus inertite}}$
positive	exinite/inertinite	Permian	Cooper	$\frac{\text{intermediates}}{\text{durite plus inertite}}$
negative	exinite/vitrinite	Triassic	Simpson Desert	
		Correlations for exinite DOM/inertinite DOM		
positive	vitrinite	Permian	Cooper	intermediates (cycle 3)
positive	exinite	Permian	Cooper	
negative	inertinite	Permian	Cooper	
positive	exinite/vitrinite	Permian	Cooper	vitrite plus clarite
negative		Permian	Cooper	durite plus inertite
positive	vitrinite/inertinite	Permian	Cooper	$\frac{\text{vitrite plus clarite}}{\text{durite plus inertite}}$

Table 9.2 (cont'd) Correlations for exinite DOM

Correlations	Coal macerals	Age	Basin	Coal microlithotypes
positive	exinite/inertinite	Permian	Cooper	$\frac{\text{intermediates}}{\text{durite plus inertite}}$
positive	exinite	Jurassic	Eromanga	

Table 9.3 Correlations for inertinite DOM

Correlation	Coal macerals	Age	Basin	Coal microlithotypes
negative	vitrinite	Permian	Cooper	
positive	inertinite	Permian	Cooper	
negative	vitrinite / inertinite	Permian	Cooper	
negative	exinite / inertinite	Permian	Cooper	
negative		Permian	Cooper	vitrite plus clarite
positive		Permian	Cooper	durite plus inertite
negative		Permian	Cooper	vitrite plus clarite / durite plus inertite
negative		Permian	Cooper	intermediates / durite plus inertite
negative	exinite / inertinite	Jurassic	Eromanga	

Table 9.4 Ratings of formations as potential hydrocarbon source rocks in the Cooper, Pedirka, Simpson Desert and Eromanga Basins

DOM only.

FORMATION	% volume DOM	Rating	V	E	I	% volume V+E only	Rating
			TINDILPIE 1				
Hutton	2.2	fair	30	12	58	0.9	poor
Nappamerri	1.0	poor	11	5	84	0.2	poor
Toolachee	2.0	fair	28	3	69	0.6	poor
Roseneath	2.1	fair	13	10	77	0.5	poor
Epsilon	2.8	good	26	4	70	0.8	poor
Murteree	3.8	good	4	16	80	0.8	poor
Patchawarra	3.0	good	21	6	73	0.8	poor
cycle 3	4.3	good	20	11	69	1.3	fair
cycle 2	3.4	good	21	1	78	0.8	poor
cycle 1	2.0	fair	23	1	76	0.5	poor
Tirrawarra	0.8	poor	17	2	81	0.2	poor
			MUDRANGIE 1				
Nappamerri	0.4	poor	6	27	67	0.1	poor
Toolachee	0.8	poor	15	16	69	0.1	poor
Murteree	5.0	excellent	0	5	95	0.3	poor
Patchawarra	4.4	good	14	1	85	0.5	poor
cycle 3	5.5	excellent	15	1	84	0.9	poor
cycles 1+2	3.7	good	13	1	86	0.5	poor
Tirrawarra	7.0	excellent	16	4	80	1.4	fair
			MACUMBA 1				
Winton	0.9	poor	23	13	64	0.3	poor
Ooodnadatta	0.3	poor	34	-	66	0.1	poor
Algebuckina	2.0	fair	32	37	31	1.4	fair
Poolowanna	1.3	fair	19	12	69	0.4	poor
Peera Peera	1.9	fair					
upper part	3.0	good	20	19	61	1.2	poor
lower part	1.0	poor	16	18	66	0.3	poor
Purni	1.7	fair	23	14	63	0.6	poor

V = vitrinite E = exinite I - inertinite
V, E, I, are weighted percentages, derived from data given in previous tables

TABLE 9.5 Ratings of formations of the Gidgealpa Group in Tindilpie 1 well, including both coal and DOM

FORMATION	% volume COAL	Rating	V	E	I	% volume E only	Rating	% volume E (COAL & DOM)	Rating	% volume V+E (COAL)	Rating
Toolachee	29	excellent	38	5	57	1.5	fair	1.5+0.06 = 1.56	fair	12.5	excellent
Roseneath	18	excellent	51	5	44	0.9	poor	0.9+0.21 = 1.11	poor	10.1	excellent
Epsilon	32	excellent	43	6	51	1.9	fair	1.9+0.11 = 2.01	fair	15.7	excellent
Murteree	6	excellent	54	8	38	0.5	poor	0.5+0.61 = 1.11	poor	3.7	good
Patchawarra											
cycle 3	30	excellent	30	4	66	1.2	poor	1.2+0.47 = 1.67	fair	10.2	excellent
cycle 2	31	excellent	27	1	72	0.3	poor	0.3+0.03 = 0.33	poor	8.7	excellent
cycle 1	33	excellent	29	1	70	0.3	poor	0.3+0.02 = 0.32	poor	9.9	excellent

V = vitrinite E = exinite I = inertinite

V, E, 1, are weighted percentages, derived from data given in previous tables.

10. CONCLUSIONS

Relationships do exist between DOM macerals in sediments and the petrographic compositions of the associated coals, both macerals and microlithotypes.

In the case of exinite DOM, the correlations depend on the botanical origin of the exinite. Exinite DOM occurs predominantly as sporinite in the Cooper and Eromanga Basins and correlates with vitrinite and sporinite in coals. Exinite which is predominantly cutinite in the Simpson Desert Basin, correlates negatively with cutinite in the coal. Exinite DOM correlates with vitrite plus clarite and intermediates in the Cooper Basin.

Vitrinite DOM correlates with vitrinite in coal (Cooper Basin), resinite in coal (Eromanga Basin) and intermediate microlithotypes (Cooper Basin).

Inertinite DOM, mostly inertodetrinite, correlates with inertodetrinite and durite plus inertite in coal (Cooper Basin).

The volumes of DOM suitably high for source potential occur in the Epsilon, Murteree and Patchawarra Formations of the Cooper Basin, and the upper part of the Peera Peera Formation of the Simpson Desert Basin.

If both exinite and vitrinite in coals can generate and liberate oil and gas, then all formations of the Gidgealpa Group, for example, (excluding the Tirrawarra Sandstone) have good to excellent potential as source rocks. In any of the coal measure sequences, inclusion of coal seams as hydrocarbon source rocks would raise the potential status of the succession to good or excellent.

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TABLE 3.1

A SUMMARY OF THE AMOUNTS AND TYPES OF DISPERSED ORGANIC MATTER IN SOME OF THE SEDIMENTS FROM FLY LAKE NO. 1 WELL, COOPER BASIN

Depth (metres)	Depth (feet)	Sample numbers	Rock Type	Total d.o.m. (vol)	Proportions of opaque and transparent d.o.m.	Opaque d.o.m. (vol) T.L.	Transparent d.o.m. (vol) T.L.	Total exinite in rock (vol) F.L.	Proportions of vitrinite to exinite	Form of transparent d.o.m. T.L.	Form of exinite d.o.m. F.L.	Sample
2578.2	8458.5	LN 43281 TS 23927 B 27361	carbonaecous siltstone	5%	O : 95 T : 5	∼ 5%	< 1%	<< 1%	V : 90 E : 10	fragments spores	spores	1.
2580.4	8466	LN 43282 TS 23928 B 27362	white sandstone	< 1%	O : 0 T : 100	-	1%	-	V : 100 E : 0	patches rims fragments	-	2.
2585.2	8481.5	LN 43284 TS 23930 B 27363	white sandstone	1%	O : 95 T : 5	∼ 1%	trace	-	V : 100 E : 0	rims around grains	-	3.
2680.7	8795	LN 43285 TS 23931 B 27364	dark grey siltstone	5%	O : 95 T : 5	∼ 5%	< 1%	-	V : 100 E : 0	patches fragments	-	4.
2685.6	8811	LN 43287 TS 23933 B 27364	fine sandstone/ siltstone	1%	O : 95 T : 5	∼ 1%	trace	-	V : 100 E : 0	fragments	-	5.
2688.9	8822	LN 43288 TS 23934 B 27366	white sandstone	-	-	-	-	-	-	-	-	6.
2691.4	8830	LN 43289 TS 23935 B 27367	black carbonaecous shale	25%	O : 95 T : 5	23%	2%	1-2%	V : 50 E : 50	fragments	spores cuticles	7.

d.o.m. dispersed organic matter
T.L. transmitted light
F.L. fluorescent light

LN laboratory number
TS thin section
B polished block

O opaque
T transparent
V vitrinite
E exinite

TABLE 3.1 (continued)

Depth (metres)	Depth (feet)	Sample Numbers	Rock Type	Total d.o.m. (vol)	Proportions of opaque and transparent d.o.m.	Opaque d.o.m. (vol) T.L.	Transparent d.o.m. (vol) T.L.	Total exinite in rock (vol) F.L.	Proportions of vitrinite to exinite	Form of transparent d.o.m. F.L.	Form of exinite d.o.m. F.L.	Sample
2691.4	8330	LN 47233 B 27360	black carbonaceous shale	-	-	-	-	1-2%	-	-	spores cuticles	8.
2692.0	8832	LN 43290 TS 23936 B 27368	black mudstone	35%	O :100 T : 0	35%	-	-	-	-	-	9.
2701.1	8862	LN 43292 TS 23938 B 27369	black shale/ siltstone	25%	O : 95 T : 5	23%	2%	<< 1%	V : 90 E : 10	fragments	spores algae	10.
2706.9	8881	LN 43293 TS 23939 B 27370	white sandstone	<< 1%	O : 0 T :100	-	<< 1%	-	V :100 E : 0	Fragments staining	-	11.
2718.8	8920	LN 42394 TS 23940 B 27371	grey and white siltstone/ sandstone	2%	O : 95 T : 5	2%	trace	<< 1%	V : 90 E : 10	stringers	spores	12.
2840.7	9320	LN 43296 TS 23942 B 27372	grey mudstone	5%	O : 95 T : 5	~ 5%	<< 1%	-	V :100 E : 0	fragments	-	13.
2849.9	9350	LN 43298 TS 23944 B 27375	sandstone	<< 1%	O : 0 T :100	-	<< 1%	-	V :100 E : 0	-	-	14.

TABLE 3.1 (continued)

Depth (metres)	Depth (feet)	Sample numbers	Rock type	Total d.o.m. (vol)	Proportions of opaque and transparent d.o.m.	Opaque d.o.m. (vol) T.L.	Transparent d.o.m. (vol) T.L.	Total exinite in rock (vol) F.L.	Proportions of vitrinite to exinite	Form of transparent d.o.m. (T.L.)	Form of exinite d.o.m. F.L.	Sample
2863.3	9394	LN 43299 TS 23945 B 27376	black silty shale	20%	O : 95 T : 5	19%	1%	~ 1%	V : 50 E : 50	stringers	spores	15.
2871.1	9419.5	LN 43300 TS 23946 B 27377	siltstone with sandy lenses	2%	O : 95 T : 5	2%	<< 1%	<< 1%	V : 70 E : 30	stringers	spores	16.
2871.2	9420	LN 43301 TS 23947 B 27378	sandstone	trace	O : 0 T : 100	-	trace	-	V : 100 E : 0	-	-	17.
2881.1	9452.5	LN 43302 TS 23948 B 27379	siltstone	< 1%	O : 100 T : 0	-	-	-	-	-	-	18.

d.o.m. dispersed organic matter
T.L. transmitted light
F.L. fluorescent light

LN laboratory number
TS thin section
B polished block

O opaque
T transparent
V vitrinite
E exinite

TABLE 3.2.

A SUMMARY OF THE AMOUNTS AND TYPES OF DISPERSED ORGANIC MATTER IN SOME OF THE SEDIMENTS FROM FLY LAKE NO. 2 WELL, COOPER BASIN

Depth (Metres)	Depth (feet)	Sample numbers	Rock type	Total d.o.m. (vol)	Proportions of opaque and transparent d.o.m.	Opaque d.o.m. (vol) T.L.	Transparent d.o.m. (vol) T.L.	Total exinite in rock (vol) F.L.	Proportions of vitrinite to exinite	Form of transparent d.o.m. (T.L.)	Form of exinite d.o.m. F.L.	Sample
2682.2	8800	LN 43303 TS 24232 B 27326	siltstone	10%	O : 90 T : 10	9%	1%	< 1%	V : 70 E : 30	stringers fragments	spores algae cuticles	1.
2691.4	8830	LN 43305 TS 24233 B 27327	laminated shale	5%	O : 70 T : 30	3.5%	1.5%	< 1%	V : 70 E : 30	stringers fragments	spores algae	2.
2693.5	8837	LN 43306 TS 24234 B 27328	sandstone	-	-	-	-	-	-	-	-	3.
2703.6	8870	LN 43309 TS 24235 B 27329	micaceous siltstone	2%	O : 95 T : 5	~ 2%	< 1%	-	V :100 E : 0	fragments	-	4.
2708.8	8887	LN 43310 TS 24236 B 27330	sandstone	< 1%	O : 95 T : 5	< 1%	trace	-	V :100 E : 0	stringer	-	5.
2710.6	8893	LN 43311 TS 24237 B 27331	sandstone	trace		-	-	-	-	-	-	6.
2712.7	8900	LN 43312 TS 24238 B 27332	carbonaceous siltstone	5%	O : 90 T : 10	4.5%	0.5%	trace	V : 95 E : 5	fragments	spores	7.

d.o.m. dispersed organic matter
T.L. transmitted light
F.L. fluorescent light

LN laboratory number
TS thin section
B polished block

O opaque
T transparent
V vitrinite
E exinite

TABLE 3.2 (continued)

Depth (metres)	Depth (feet)	Sample numbers	Rock Type	Total d.o.m. (vol)	Proportions of opaque and transparent d.o.m.	Opaque d.o.m. (vol) T.L.	Transparent d.o.m. (vol) T.L.	Total exinite in rock (vol) F.L.	Proportions of vitrinite to exinite	Form of transparent d.o.m. (T.L.)	Form of exinite d.o.m. F.L.	Sample
2749.6	9021	LH 43314 TS 24240 B 27333	Sandstone	trace	-	-	-	-	-	-	-	8.
2761.2	9059	LH 43315 TS 24241 B 27334	Carbonaceous siltstone	2-3%	O : 95 T : 5	~ 2%	< 1%	trace	V : 80 E : 20	fragments stringers	spores	9.
2804.5	9201	LH 43316 TS 24242 B 27335	Carbonaceous sandstone	5%	O : 95 T : 5	~ 5%	< 1%	-	V : 100 E : 0	streaks	-	10.
2813.3	9230	LH 43318 TS 24243 B 27336	Sandstone	1%	O : 95 T : 5	~ 1%	<< 1%	trace	V : 50 E : 50	stringers	spores	11.
2817.0	9242	LH 43319 TS 27337	Sandstone	-	-	-	-	-	-	-	-	12.
2818.5	9247	LH 46741 TS 25364	Black mudstone	40%	O : 100 T : 0	40%	-	-	-	-	-	13
[illegible]	9259	LH 46743 TS 25365	Black mudstone	40%	O : 80 T : 20	32%	8%	-	-	fragments	-	14.

TABLE 3.2 (continued)

Depth (metres)	Depth (feet)	Sample numbers	Rock type	total d.o.m. (vol)	Proportions of opaque and transparent d.o.m.	Opaque d.o.m. (vol) T.L.	Transparent d.o.m. (vol) T.L.	Total exinite in rock (vol) F.L.	Proportions of vitrinite to exinite	Form of transparent d.o.m. (T.L.)	Form of exinite d.o.m. F.L.	Sample
2827.0	9275	LN 43322 TS 24244 B 27338	Carbonaceous siltstone/ shale	20%	O : 95 T : 5	19%	1%	< 1%	V : 50 E : 50	stringers	spores	15.
2842.9	9327	LN 43326 TS 24245 B 27339	Carbonaceous mudstone	30%	O : 50 T : 50	15%	15%	-	V : 100 E : 0	fragments	-	16.
2864.8	9399	LN 43327 TS 24246 B 27340	Sandstone	< 1%	O : 95 T : 5	< 1%	trace	-	-	fragments stringers	-	17.
2890.4	9483	LN 43329 TS 24247 B 27341	Carbonaceous shale	10%	O : 95 T : 5	9.5%	0.5%	<< 1%	V : 95 E : 5	fragments stringers	spores	18.
2903.0	9544	LN 43336 TS 24248 B 27344	Siltstone	3%	O : 95 T : 5	~ 3%	<< 1%	-	V : 100 E : 0	stringers	-	22.

d.o.m. dispersed organic matter
T.L. transmitted light
F.L. fluorescent light

LN laboratory number
TS thin section
B polished block

O opaque
T transparent
V vitrinite
E exinite

TABLE 3.3

A SUMMARY OF THE AMOUNTS AND TYPES OF DISPERSED ORGANIC MATTER IN SOME OF THE SEDIMENTS FROM FLY LAKE NO. 3 WELL, COOPER BASIN

Depth (Metres)	Depth (feet)	Sample numbers	Rock type	Total d.o.m. (vol)	Proportions of opaque and transparent d.o.m.	Opaque d.o.m. (vol) T.L.	Transparent d.o.m. (vol) T.L.	Total exinite in rock (vol) F.L.	Proportions of vitrinite to exinite	Form of transparent d.o.m. (T.L.)	Form of exinite d.o.m. F.L.	Sample
2651.5	8699	LN 46757 TS 25366 B 27058	sandstone	~ 2%	O : 100 T : 0	~ 2%	-	< 1%	-	-	spores algae	1.
2654.2	8708	LN 46758 TS 25367 B 27059	siltstone	25%	O : 99 T : 1	25%	<< 1%	1-2%	-	fragments stringers	spores algae cuticles	2.
2660.4	8728.5	LN 46762 TS 25368 B 27060	mudstone	5%	O : 100 T : 0	5%	-	<< 1%	-	-	spores	3.
2661.8	8733	LN 46763 TS 25369 B 27061	carbonaceous shale	3-4%	O : 100 T : 0	3-4%	-	< 1%	V : 90 E : 10	-	spores cuticles	4.
2668.2	8754	LN 46765 TS 25370 B 27062	siltstone	10%	O : 100 T : 0	10%	-	1%	-	-	spores cuticles algae	5.
2671.1	8763.5	LN 46768 TS 25371 B 27063	shale	30%	O : 98 T : 2	29.5%	0.5%	5%	V : 10 E : 90	fragments	spores algae cuticles	6.
2673.1	8770	LN 46769 TS 25372 B 27064	carbonaceous mudstone	30%	O : 99 T : 1	~ 30%	< 1%	3-4%	-	algae	spores algae	7.
2674.6	8775	LN 46770 TS 25373 B 27065	carbonaceous shale	40%	O : 100 T : 0	40%	-	2%	-	-	spores algae cuticles	8.

TABLE 3.3 (continued)

A SUMMARY OF THE AMOUNTS AND TYPES OF DISPERSED ORGANIC MATTER IN SOME OF THE SEDIMENTS FROM FLY LAKE NO.3 WELL, COOPER BASIN

Depth (Metres)	Depth (Feet)	Sample numbers	Rock type	Total d.o.m. (vol)	Proportions of opaque and transparent d.o.m.	Opaque d.o.m. (vol) T.L.	Transparent d.o.m. (vol) T.L.	Total exinite in rock (vol) F.L.	Proportions of vitrinite to exinite	Form of transparent d.o.m. (T.L.)	Form of exinite d.o.m. F.L.	Sample
2677.7	8785	LN 46772 TS 25374 B 27066	carbonaceous shale	20%	O : 90 T : 10	18%	2%	1%	V : 50 E : 50	fragments	cuticles spores algae	9.
2679.3	8790.5	LN 46773 TS 25375 B 27067	siltstone	2%	O : 100 T : 0	2%	-	<< 1%	-	-	spores	10.
2681.5	8797.5	LN 46776 TS 25376 B 27068	shale		O : 100 T : 0	5%	-	<< 1%	-	-	spores	11.
2684.4	8807	LN 46781 TS 25377 B 27069	siltstone	20%	O : 99 T : 1	20%	< 1%	< 1%	V : 50 E : 50	fragments stringers	spores	12.
2800.5	9188	LN 46782 TS 25378 B 27070	sandstone	3%	O : 100 T : 0	3%	-	<< 1%	-	-	spores	13.
2804.0	9199.5	LN 46783 TS 25379 B 27071	carbonaceous siltstone	-	O : 98 T : 2	-	-	<< 1%	-	stringers	spores	14.
2807.1	9209.5	LN 46787 TS 25380 B 27072	carbonaceous shale	2-3%	O : 100 T : 0	2-3%	-	< 1%	-	-	spores cuticles	15.
2809.0	9216	LN 46788 TS 25381 B 27073	siltstone	10%	O : 100 T : 0	10%	-	-	-	-	-	16.

TABLE 3.3 (continued)

A SUMMARY OF THE AMOUNTS AND TYPES OF DISPERSED ORGANIC MATTER IN SOME OF THE SEDIMENTS FROM FLY LAKE NO. 3 WELL, COOPER BASIN

Depth (metres)	Depth (feet)	Sample numbers	Rock type	Total d.o.m. (vol)	Proportions of opaque and transparent d.o.m.	Opaque d.o.m. (vol) T.L.	Transparent d.o.m. (vol) T.L.	Total exinite in rock (vol) F.L.	Proportions of vitrinite to exinite	Form of transparent d.o.m. (T.L.)	Form of exinite d.o.m. F.L.	Sample
2810.9	9222	LH 46789 TS 25382 B 27074	shale	10%	O : 80 T : 20	8%	2%	<< 1%	V : 95 E : 5	stringers fragments	spores	17.
2837.7	9310	LH 46790 TS 25383 B 27075	siltstone	30%	O : 99 T : 1	29.5%	0.5%	<< 1%	V : 90 E : 10	stringers	spores	18.
2840.1	9318	LH 46791 TS 25384 B 27127	mudstone- silty lenses	7%	O : 85 T : 15	6%	1%	-	V : 100 E : 0	fragments	-	19.
2842.0	9324	LH 46793 TS 25385	sandstone- carbonaceous blebs	2%	O : 100 T : 0	2%	-	-	-	-	-	20.
2843.8	9330	LH 46794 TS 25386 B 271?9	silty sandstone	15%	O : 100 T : 0	15%	-	-	-	-	-	21.
2845.3	9335	LH 46795 TS 25387 B 27130	carbonaceous shale	40%	O : 10 T : 90	4%	36%	1%	V : 97 E : 3	bands	spores cuticles algae	22.
2847.0	9340.5	LH 46796 TS 25388 B 27131	shale	20%	O : 95 T : 1	19%	1%	-	V : 100 E : 0	fragments stringers	-	23.
2849.9	9350	LH 46799 TS 25389 B 27132	carbonaceous siltstone	20%	O : 100 T : 0	20%	-	-	-	-	-	24.

TABLE 3.3. (continued)

SUMMARY OF THE AMOUNTS AND TYPES OF DISPERSED ORGANIC MATTER IN SOME OF THE SEDIMENTS FROM FLY LAKE NO. 3 WELL, COOPER BASIN

Depth (metres)	Depth (feet)	Sample numbers	Rock type	Total d.o.m. (vol)	Proportions of opaque and transparent d.o.m.	Opaque d.o.m. (vol) T.L.	Transparent d.o.m. (vol) T.L.	Total exinite in rock (vol) F.L.	Proportions of vitrinite to exinite	Form of transparent d.o.m. (T.L.)	Form of exinite d.o.m. F.L.	Sample
2854.8	9366	LN 46800 TS 25390 B 27133	carbonaceous shale	20%	O : 20 T : 80	4%	16%	-	V : 100 E : 0	fine stringers fragments	-	25.
2855.1	9367	LN 46801 TS 25391 B 27134	siltstone	2%	O : 100 T : 0	2%	-	-	-	-	-	26.
2858.1	9377	LN 46803 TS 25392 B 27135	mudstone with pellets	2%	O : 98 T : 2	~ 2%	trace	-	V : 100 E : 0	fragments	-	27.
2876.4	9437	LN 46807 TS 25393 B 27136	mudstone	10%	O : 100 T : 0	10%	-	-	-	-	-	28.
2877.9	9442	LN 46809 TS 25394 B 27137	micaceous mudstone	25%	O : 98 T : 2	24.5%	0.5%	-	V : 100 E : 0	fragments stringers	-	29.
2879.4	9447	LN 46810 TS 25395 B 27138	carbonaceous shale	3%	O : 98 T : 2	~ 3%	trace	-	V : 100 E : 0	fragments	-	30.
2879.8	9448	LN 46811 TS 25396 B 27139	carbonaceous shale	20%	O : 50 T : 50	10%	10%	-	V : 100 E : 0	fragments stringers	-	31.

TABLE 3.3 (continued)

A SUMMARY OF THE AMOUNTS AND TYPES OF DISPERSED ORGANIC MATTER IN SOME OF THE SEDIMENTS FROM FLY LAKE NO. 3 WELL, COOPER BASIN

Depth (metres)	Depth (feet)	Sample numbers	Rock type	Total d.o.m. (vol)	Proportions of opaque and transparent d.o.m.	Opaque d.o.m. (vol) T.L.	Transparent d.o.m. (vol) T.L.	Total exinite in rock (vol) F.L.	Proportions of vitrinite to exinite	Form of transparent d.o.m. (T.L.)	Form of exinite d.o.m. F.L.	Sample
2881.0	9452	LN 46812 TS 25397 B 27140	mudstone	30%	O : 99 T : 1	29.5%	0.5%	<< 1%	V : 95 E : 5	fragments		32.
2882.6	9457.5	LN 46813 TS 25398 B 27141	siltstone	20%	O : 98 T : 2	19.5%	0.5%	-	V : 100 E : 0	fragments	-	33.
2885.2	9466	LN 46814 TS 25399 B 27142	carbonaceous shale	25%	O : 99 T : 1	25%	trace	<< 1%	V : 0 E : 100	spores		34.
2890.1	9482	LN 46816 TS 25400 B 27143	micaceous siltstone	10%	O : 99 T : 1	10%	trace	-	V : 100 E : 0	fragments	-	35.
2892.2	9489	LN 46817 TS 25401 B 27144	siltstone	15%	O : 75 T : 25	11%	4%	<< 1%	V : 99 E : 1	fragments		36.
2895.0	9498	LN 46818 TS 25402 B 27223	sandstone	-	-	-	-	-	-	-	-	37.
2897.3	9505.5	LN 46819 TS 25403 B 27224	mudstone	10%	O : 99 T : 1	10%	trace	-	-	fragments stringers	-	38.
2899.1	9511.5	LN 46823 TS 25404 B 27225	carbonaceous shale	20%	O : 95 T : 5	19%	1%	< 1%	V : 70 E : 30	spores	cuticles spores	39.

TABLE 3.3 (continued)

A SUMMARY OF THE AMOUNTS AND TYPES OF DISPERSED ORGANIC MATTER IN SOME OF THE SEDIMENTS FROM FLY LAKE NO. 3 WELL, COOPER BASIN

Depth (metres)	Depth (feet)	Sample numbers	Rock type	Total d.o.m. (vol)	Proportions of opaque and transparent d.o.m.	Opaque d.o.m. (vol) T.L.	Transparent d.o.m. (vol) T.L.	Total exinite in rock (vol) F.L.	Proportions of vitrinite to exinite	Form of transparent d.o.m. (T.L.)	Form of exinite d.o.m. F.L.	Sampl
2900.5	9516	LN 46824 TS 25405 B 27226	mudstone	25%	O : 98 T : 2	24.5%	0.5%	-	V : 100 E : 0	fragments	-	40.
2902.0	9521	LN 46826 TS 25406 B 27227	carbonaceous shale	8%	O : 97 T : 3	8%	tr	-	V : 100 E : 0	stringers	-	41.
2902.9	9224	LN 46827 TS 25407 B 27228	carbonaceous shale	35%	O : 90 T : 10	31.5%	3.5%	≥ 1%	V : 75 E : 25	bands fragments	spores cuticles spores	42.
2906.3	9535	LN 46833 TS 25408 B 27229	carbonaceous mudstone	15%	O : 99 T : 1	14%	1%	≪ 1%	V : 95 E : 5	fragments		43.
2906.9	9537	LN 46834 TS 25409 B 27230	shaly coal	70%	O : 10 T : 90	7%	63%	≪ 1%	V : 99 E : 1	fragments		44.
2908.1	9541	LN 46834 TS 25410 B 27231	carbonacecus shale	35%	O : 70 T : 30	24.5%	10.5%	-	V : 100 E : 0	fragments stringers	-	45.
2908.4	9542	LN 46836 TS 25411 B 27232	siltstone	25%	O : 100 T : 0	25%	-	-	-	-	-	46.

TABLE 3.3 (continued)

A SUMMARY OF THE AMOUNTS AND TYPES OF DISPERSED ORGANIC MATTER IN SOME OF THE SEDIMENTS FROM FLY LAKE NO. 3 WELL, COOPER BASIN

Depth (metres)	Depth (feet)	Sample numbers	Rock type	Total d.o.m. (vol)	Proportions of opaque and transparent d.o.m.	Opaque d.o.m. (vol) T.L.	Transparent d.o.m. (vol) T.L.	Total exinite in rock (vol) F.L.	Proportions of vitrinite to exinite	Form of transparent d.o.m. (T.L.)	Form of exinite d.o.m. F.L.	Samp
2909.9	9547	LH 46841 TS 25412 B 27233	shale	20%	O : 99 T : 1	19%	1%	-	V : 100 E : 0	stringers fragments	-	47.
2911.8	9553	LH 46842 TS 25413 B 27234	siltstone	3%	O : 100 T : 0	3%	-	-	-	-	-	48.
2915.3	9564.5	LH 46843 TS 25414 B 27235	sandstone	3%	O : 100 T : 0	3%	-	-	-	-	-	49.
2918.8	9576	LH 46844 TS 25415 B 27236	coaly shale	15%	O : 50 T : 50	7.5%	7.5%	-	V : 100 E : 0	fragments	-	50.
2919.7	9579	LH 46847 TS 25416 B 27237	carbonaceous shale	50%	O : 100 T : 0	50%	-	<< 1%	-	-	cuticles spores	51.
2922.1	9587	LH 46849 TS 25417 B 27238	sandstone	5%	O : 100 T : 0	5%	-	-	-	-	-	52.

d.o.m. dispersed organic matter
T.L. transmitted light
F.L. fluorescent light

L.H. laboratory number
T.S. thin section
B. polished block

O. opaque
T. transparent
V. vitrinite
E. exinite

TABLE 3.4

A SUMMARY OF THE AMOUNTS AND TYPES OF DISPERSED ORGANIC MATTER IN SOME OF THE SEDIMENTS FROM BROLGA NO.1 WELL, COOPER BASIN

Depth (metres)	Depth (feet)	Sample numbers	Rock type	Total d.o.m. (vol)	Proportions of opaque and transparent d.o.m.	Opaque d.o.m. (vol) T.L.	Transparent d.o.m. (vol) T.L.	Total exinite in rock (vol) F.L.	Proportions of vitrinite to exinite	Form of transparent d.o.m. (T.L.)	Form of exinite d.o.m. F.L.	Sample
2722.8	8933	LH 47150 TS 25508 B 27145	black carbonaceous shale	40%	O : 50 T : 50	20%	20%	1%	V : 95 E : 5	Fragments	spores algae cuticles	1.
2726.0	8943.5	LH 47152 TS 25509 B 27146	grey carbonaceous shale	10%	coarse O : 50 T : 50 fine O : 100 T : 0	7.5%	2.5%	1%	V : 90 E : 10	stringers (coarse)	spores cuticles	2.
2728.0	8950	LH 47153 TS 25569 B 27147	fine-grained sandstone	< 1%	O : 95 T : 5	< 1%	<< 1%	<< 1% << 1%	V : 0 E : 100	not observed	spores algae	3.
2730.1	8957	LH 47154 TS 25570 B 27148	carbonaceous siltstone	10%	O : 99 T : 1	9%	1%	< 1%	V : 10 E : 90	fragments	spores algae cuticles	4.
2734.1	8970	LH 47155 TS 25571 B 27149	carbonaceous siltstone	40%	O : 99 T : 1	39%	1%	1%	V : 10 E : 90	fragments spores	spores algae	5.
2734.4	8971	LH 50019 TS 26612 B 26904	carbonaceous sandstone/ siltstone	5%	O : 95 T : 5	5%	<< 1%	<< 1%	V : 90 E : 10	stringers lenses	cuticles spores	6.
2734.7	8972	LH 50020 TS 26613 B 26905	carbonaceous siltstone/ sandstone	7%	O : 99 T : 1	7%		<< 1%	-	stringers	spores	7.

d.o.m. = dispersed organic matter
LH = laboratory number
O = opaque
T = transparent
T.L. = transmitted light
TS = thin section
V = vitrinite
F.L. = fluorescent light
B = polished block
E = exinite

TABLE 3.4 (continued)

A SUMMARY OF THE AMOUNTS AND TYPES OF DISPERSED ORGANIC MATTER IN SOME OF THE SEDIMENTS FROM BROLGA NO.1 WELL, COOPER BASIN

Depth (metres)	Depth (feet)	Sample numbers	Rock type	Total d.o.m. (vol)	Proportions of opaque and transparent d.o.m.	Opaque d.o.m. (vol) T.L.	Transparent d.o.m. (vol) T.L.	Total exinite in rock (vol) F.L.	Proportions of vitrinite to exinite	Form of transparent d.o.m. (T.L.)	Form of exinite d.o.m. F.L.	Ser
2735.0	8973	LH 50021 TS 26614 B 26905	carbonaceous shale with silty lenses	20%	O : 50 T : 50	10%	10%	2-3%	V : 75 E : 25	spores algae	spores algae	8.
2735.3	8974	LH 50022 TS 26615 B 26907	black shale with silty lenses	40%	O : 40 T : 60	16%	24%	2-3%	V : 90 E : 10	fragments	spores algae cuticles	9.
2735.4	8974.5	LH 50023 TS 26616 B 26908	black shale with silty lenses	10%	O : 20 T : 80	2%	8%	4-5%	V : 50 E : 50	fragments	spores algae	10.
2735.6	8975	LH 47156 TS 25510 B 27150	black shale	30%	O : 40 T : 60	12%	18%	5-10%	V : 50 E : 50	fragments algae	algae spores cuticles	11.
2736.2	8977	LH 50025 TS 26618 B 269[illegible]9	grey siltstone	15%	O : 99 T : 1	15%	< 1%	<< 1%	V : 5 E : 95	spores	spores algae	12.
2736.5	8978	LH 50026 TS 26619 B 26910	siltstone	40%	O : 60 T : 40	24%	16%	1%	V : 95 E : 5	fragments	spores algae	13.
2737.0	8979.5	LH 47157 TS 25572 B 27151	siltstone with coaly lenses	12%	O : 80 T : 20	10%	2.1%	< 1%	V : 80 E : 20	fragments	spores cuticles	14.
2738.8	8985.5	LH 47158 TS 25573 B 27152	laminated carbonaceous siltstone	5%	O : 95 T : 5	5%	tr	<< 1%	V : 50 E : 50	stringers fragments	cuticles spores	15.

TABLE 3.4 (continued)

Depth (metres)	Depth (feet)	Sample Numbers	Rock type	Total d.o.m. (vol)	Proportions of opaque and transparent d.o.m.	Opaque d.o.m. (vol) T.L.	Transparent d.o.m. (vol) T.L.	Total exinite in rock (vol) F.L.	Proportions of vitrinite to exinite	Form of transparent d.o.m. (T.L.)	Form of exinite d.o.m. F.L.	Sample
2820.3	9253	LH 47165 TS 25511 B 27153	carbonaceous shale	10%	O : 90 T : 10	9%	1%	< 1%	V : 50 E : 50	fragments	spores	16.
2823.4	9263	LH 47167 TS 25574 B 27154	dark grey carbonaceous siltstone	10%	O : 100 T : 0	10%	-	-	-	-	-	17.
2825.5	9270	LH 47169 TS 25575 B 27155	sandstone with carbonaceous streaks	1%	O : 100 T : 0	1%	-	trace	-	-	spores	18.
2833.4	9296	LH 47180 TS 25576 B 27156	micaceous sandstone	2-3%	O : 100 T : 0	2-3%	-	-	-	-	-	19.
2840.1	9318	LH 47181 TS 25512 B 27157	sandstone	< 1%	O : 100 T : 0	< 1%	-	-	-	-	-	20.
2845.0	9334	LH 47184 TS 25577 B 27158	dark grey carbonaceous siltstone	10%	O : 95 T : 5	9.5%	0.5%	-	V : 100 E : 0	fragments	-	21.
2845.6	9336	LH 77185 TS 25513 B 27159	black carbonaceous shale	30%	O : 50 T : 50	15%	15%	-	V : 100 E : 0	fragments	-	22.

TABLE 3.4 (continued)

Depth (metres)	Depth (feet)	Sample numbers	Rock type	Total d.o.m. (vol)	Proportions of opaque and transparent d.o.m.	Opaque d.o.m. (vol) T.L.	Transparent d.o.m. (vol) T.L.	Total exinite in rock (vol) F.L.	Proportions of vitrinite to exinite	Form of transparent d.o.m. (T.L.)	Form of exinite d.o.m. F.L.	Sample
2848.7	9346	LN 47186 TS 25578 B 27160	black carbonaceous shale	5%	O : 90 T : 10	4.5%	0.5%	-	V : 100 E : 0	fragments stringers	-	23.
2852.2	9357.5	LN 47188 TS 25580 B 27175	grey carbonaceous siltstone	5%	O : 100 T : 0	5%	-	-	-	-	-	24.
2903.2	9525	LN 47189 TS 25581 B 27161	dark grey carbonaceous silty shale	10%	O : 100 T : 0	10%	-	-	-	-	-	25.
2906.9	9537	LN 47190 TS 25514 B 27176	sandstone with carbonaceous patches	-	-	-	-	-	-	-	-	26.
2911.5	9552	LN 47191 TS 25582 B 27162	grey siltstone	5-10%	O : 70 T : 30	5%	2.5%	-	V : 100 E : 0	fragments	-	27.
2915.0	9563.5	LN 47192 TS 25583 B 27163	siderite band	15%	O : 95 T : 5	14%	1%	<< 1%	V : 90 E : 10	stringers	spores	28
2917.5	9572	LN 47193 TS 25513 B 27164	fossiliferous black shale	10%	O : 60 T : 40	6%	4%	trace	V : 99 E : 1	fragments	spores	29
2923.3	9591	LN 47195 TS 25584 B 27165	fine-grained sandstone	1-2	O : 100 T : 0	1-2%	-	-	-	-	-	30

TABLE 3.4 (continued)

Depth (metres)	Depth (feet)	Sample numbers	Rock type	Total d.o.m. (vol)	Proportions of opaque and transparent d.o.m.	Opaque d.o.m. (vol) T.L.	Transparent d.o.m. (vol) T.L.	Total exinite in rock (vol) F.L.	Proportions of vitrinite to exinite	Form of transparent d.o.m. (T.L.)	Form of exinite d.o.m. F.L.	Sample
2923.9	9593	LN 47196 TS 25585 B 27166	carbonaceous shale	15%	O : 99 T : 1	15%	<< 1%	trace	V : 60 E : 40	stringers	spores cuticles	31.
2925.2	9597	LN 47197 TS 25586 B 27167	dark grey shale	10%	O : 100 T : 0	10%	-	-	-	-	-	32.
2926.1	9600	LN 47199 TS 25587 B 27168	carbonaceous siltstone	5-10%	O : 90 T : 10	7%	1%	-	V : 100 E : 0	stringers fragments	-	33.
2927.9	9606	LN 47201 TS 25588 B 27169	laminated shale and siltstone	5 or 20%	O : 95 T : 5	9.5%	0.5%	-	V : 100 E : 0	fragments stringers	-	34.
2933.2	9623.3	LN 47203 TS 25589 B 27170	dark grey shale	2-3%	O : 100 T : 0	2-3%	-	-	-	-	-	35.
2935.2	9630	LN 47204 TS 25590 B 27171	carbonaceous lithic sand-stone	5%	O : 100 T : 0	5%	-	-	-	-	-	36.

TABLE 3.4 (continued)

Depth (metres)	Depth (feet)	Sample numbers	Rock type	Total d.o.m. (vol)	Proportions of opaque and transparent d.o.m.	Opaque d.o.m. (vol) T.L.	Transparent d.o.m. (vol) T.L.	Total exinite in rock (vol) F.L.	Proportions of vitrinite to exinite	Form of transparent d.o.m. (T.L.)	Form of exinite d.o.m. F.L.	Sample
2944.4	9660	LN 47205 TS 25516 B 27172	coarse lithic sandstone	-	-	-	-	-	-	-	-	37.
2951.1	9682	LN 47206 TS 25591 B 27173	grey mudstone	< 1%	O : 99 T : 1	< 1%	trace	-	-	-	-	38.

d.o.m. = dispersed organic matter

LN = laboratory number

O = opaque

T.L. = transmitted light

TS = thin section

T = transparent

V = vitrinite

F.L. = fluorescent light

B = polished block

E = exinite

TABLE 3.5 (i)

MACERAL ANALYSES OF COALS FROM FLY LAKE NO.1 WELL, COOPER BASIN

(Results are given as percentages by volume unless otherwise stated)

Lab. No.	Depth Feet	Depth (m)	Vitrinite	Exinite	Inertodetrinite∅	Semifusinite	Fusinite	Mineral Matter Cy.	Cb.	Py.	Q.	Oth.
43280	8446.5	2574.5	9	5	42	32	1	11	-	tr	tr	-
47209			9	5	39	32	2	12	-	-	1	-
47210	8447.5	2574.8	19	4	29	42	1	5	-	tr	tr	-
47211	8448.5	2575.1	34	3	15	37	5	6	tr	-	tr	-
47212	8449.5	2575.4	36	6	7	28	2	19	-	tr	2	-
47213	8450.5	2575.7	55	2	8	24	4	7	-	-	tr	-
47214	8451.5	2576.0	56	1	15	21	2	4	-	-	1	-
47215	8452.5	2576.3	11	1	35	39	3	10	-	-	1	-
47216	8453.5	2576.6	17	4	26	44	3	6	-	-	-	-
47217	8454.5	2576.9	41	1	18	31	2	7	-	tr	-	tr
47218	8455.5	2577.2	49	3	16	25	1	6	-	tr	tr	-
47219	8456.5	2577.5	14	4	41	33	3	4	-	-	1	-
1. Seam average			29	3	24	32	3	8	tr	tr	1	tr
mineral matter-free			32	3	27	25	3	-	-	-	-	-

Cy. - Clay
Cb. - Carbonate.
Py. - Pyrite.
Q. - Quartz.
Oth. - Other minerals.
∅ includes micrinite

TABLE 3.5 (ii)

MACERAL ANALYSES OF COALS FROM FLY LAKE NO.1 WELL, COOPER BASIN

(Results are given as percentages by volume unless otherwise stated)

Lab. No.	Depth Feet	Depth (m)	Vitrinite	Exinite	Inertodetrinite∅	Semifusinite	Fusinite	Mineral Matter Cy.	Cb.	Py.	Q.	Oth.
47220	8471.5	2582.1	35	8	23	30	3	1	tr	tr	-	-
47221	8472.5	2582.4	8	4	41	39	3	5	-	-	tr	-
47222	8473.5	2582.7	5	5	60	21	2	7	-	-	tr	-
47223	8474.5	2583.0	13	2	40	39	2	4	-	tr	tr	-
47224	8475.5	2583.3	7	4	45	34	4	5	tr	-	1	-
43283	8476	2583.5	13	4	34	43	1	5	-	-	tr	-
47225	8476.5	2583.6	15	4	41	31	4	4	-	-	1	-
47226	8477.5	2583.9	20	4	34	35	3	3	-	-	1	-
47227	8478.5	2584.2	50	3	14	25	5	2	-	-	1	-
			DIRT BAND									
47228	8479.5	2584.6	31	1	5	12	1	41	-	-	9	-
2.	Seam Average	excluding dirt band	19	4	37	33	3	4	tr	tr	tr	-
	Mineral matter-free		20	4	39	34	3	-	-	-	-	-

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite

Q. - Quartz
Oth. - Other minerals

∅ includes micrinite

TABLE 3.5 (iii)

MACERAL ANALYSES OF COALS FROM FLY LAKE NO.1 WELL, COOPER BASIN

(Results are given as percentages by volume unless otherwise stated)

Lab. No.	Depth Feet	Depth (m)	Vitrinite	Exinite	Inertodetrinite∅	Semifusinite	Fusinite	Mineral Matter				
								Cy.	Cb.	Py.	Q.	Oth.
47229	8801.5	2682.7	47	5	18	26	3	1	-	-	-	-
47230	8802	2682.8	62	3	2	3	tr	30	-	tr	-	-
47231	8804	2683.5	21	5	26	40	4	4	-	-	tr	-
43286	8805	2683.8	45	4	12	34	1	4	-	tr	tr	-
47232	8805.5	2683.9	22	4	38	31	1	3	-	-	1	-
47233	8806.5	2684.2	8	4	59	24	2	2	-	-	1	-
47234	8807.5	2684.5	28	4	41	23	1	2	-	-	1	-
47235	8808.5	2684.8	72	7	3	6	4	8	-	-	tr	-
3.	Seam average		38	5	25	23	2	7	-	tr	tr	-
	Mineral matter-free		41	5	27	25	2	-	-	-	-	-

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite
Q. - Quartz
Oth. - Other minerals

∅ includes micrinite

TABLE 3.5 (iv)

MACERAL COMPOSITION OF COALS FROM FLY LAKE NO.1 WELL, COOPER BASIN

(Results are given as percentages by vclume unless otherwise stated)

Lab. Nc.	Depth Feet	Depth (m)	Vitri-nite	Exin-ite	Inert-odetr-initeØ	Semifus-inite	Fusin-ite	Mineral Matter				
								Cy.	Cb.	Py.	Q.	Oth.
47236	8828	2690.8	40	2	21	31	4	2	-	-	-	-
47237	8829	2691.1	60	6	2	3	2	26	-	tr	1	-
						DIRT BAND						
47238	8830	2691.4	45	2	1	1	tr	50	-	-	1	-
47239	8831	2691.7	58	2	7	28	4	1	-	tr	-	-
47240	8833	2692.3	43	2	15	34	3	3	-	-	tr	-
4.	Seam exluding Average dirt band		50	3	12	24	3	8	-	tr	tr	-
	Mineral matter-free		55	3	13	26	3	-	-	-	-	-

Cy. - Clay.
Cb. - Carbonate.
Py. - Pyrite

Q. - Quartz
Oth. - Other minerals

Ø includes micrinite

TABLE 3.5 (v)

MACERAL ANALYSES OF COALS FROM FLY LAKE NO.1 WELL, COOPER BASIN

(Results are given as percentages by volume unless otherwise stated)

Lab. No.	Depth Feet	Depth (m)	Vitrinite	Exinite	Inertodetrinite∅	Semifusinite	Fusinite	Mineral Matter Cy.	Cb.	Py.	Q.	Oth.
47241	8850	2697.5	47	3	12	31	5	2	-	-	tr	-
47242	8851	2697.8	7	4	63	15	2	8	-	-	1	-
47243	8852	2698.1	6	3	57	20	2	10	tr	-	2	-
43291	8853	2698.4	8	5	59	14	2	8	2	tr	2	tr
47244	8853		4	7	56	27	1	3	-	-	2	-
47245	8854	2698.7	20	5	33	33	6	3	-	-	tr	-
47246	8855	2699.0	15	2	28	45	4	5	tr	-	1	-
47247	8856	2699.3	83	10	2	3	1	1	-	-	-	-
47248	8857	2699.6	62	1	5	26	3	3	-	tr	-	-
47249	8858	2699.9	56	5	13	22	2	2	-	-	tr	-
47250	8859	2700.2	4	3	70	13	1	6	tr	-	3	-
47251	8860	2700.5	2	6	80	6	2	3	tr	tr	1	-
47252	8861	2700.8	9	3	51	30	2	4	-	-	1	-
47253	8862	2701.1	39	1	14	34	9	3	-	-	-	-
47254	8863	2701.4	4	2	59	21	1	12	-	-	1	-
47255	8864	2701.7	3	6	82	7	1	1	-	-	-	-
47256	8865	2702.1	35	2	18	38	5	2	-	-	-	-
5. Seam Average			24	4	41	23	3	4	tr	tr	1	tr
Mineral matter-free			26	4	43	24	3	-	-	-	-	-

Cy. - Clay.
Cb. - Carbonate
Py. - Pyrite

Q. - Quartz
Oth. - Other minerals

∅ includes micrinite

TABLE 3.5 (vi)

COOPER BASIN : FLY LAKE NO.1 WELL

MACERAL ANALYSES OF THE MALABINE COAL

(Results are given as percentages by volume unless otherwise stated)

Lab. No.	Depth Feet	Depth (m)	Vitrinite	Exinite	Inertodetrinite∅	Semifusinite	Fusinite	Mineral Matter Cy.	Cb.	Py.	Q.	Oth.
47257	8956	2729.8	15	2	39	38	2	3	1	-	-	-
47258	8957	2730.1	11	2	41	41	3	2	tr	-	-	-
47259	8958	2730.4	7	tr	44	42	3	4	-	-	-	-
47260	8959	2730.7	5	4	55	25	2	9	-	-	-	-
47261	8960	2731.0	1	2	65	21	1	10	-	tr	tr	-
47262	8961	2731.3	9	2	51	30	3	5	-	-	-	-
47263	8962	2731.6	31	4	22	33	3	7	-	-	-	-
47264	8963	2731.9	38	6	22	29	3	2	-	-	-	-
47265	8964	2732.2	20	2	31	43	1	3	-	-	tr	-
47266	8965	2732.5	54	7	17	21	tr	1	-	-	-	-
47267	8966	2732.8	9	1	23	63	-	4	-	-	-	-
47268	8967	2733.1	16	2	37	39	2	4	-	-	-	-
47269	8968	2733.4	2	4	69	22	-	3	-	-	tr	-
47270	8968	2733.8	4	4	56	32	1	3	-	-	-	-
47271	8970	2734.1	51	2	13	26	3	5	-	-	-	-
47272	8971	2734.4	54	3	10	24	2	7	-	-	-	-

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite

Q. - Quartz
Oth. - Other minerals

∅ includes micrinite
Tr - trace

TABLE 3.5 (vi) (cont'd)

COOPER BASIN : FLY LAKE NO.1 WELL

MACERAL ANALYSES OF THE MALABINE COAL

(Results are given as percentages by volume unless otherwise stated)

Lab. No.	Depth Feet	Depth (m)	Vitrinite	Exinite	Inertodetrinite∅	Semifusinite	Fusinite	Mineral Matter Cy.	Cb.	Py.	Q.	Oth.
47273	8972	2734.7	27	2	23	43	3	2	-	-	-	-
47274	8973	2735.0	49	3	16	22	2	7	-	tr	1	-
47275	8974	2735.3	22	4	29	39	3	2	1	-	-	-
47276	8975	2735.6	6	2	53	35	1	3	-	-	tr	-
47277	8976	2735.9	20	2	27	45	2	4	-	-	tr	-
47278	8977	2736.2	1	3	54	35	3	4	-	-	-	-
47279	8978	2736.5	2	2	68	17	1	9	1	-	-	-
47280	8979	2736.8	18	3	40	35	2	2	-	-	tr	-
47281	8980	2737.1	11	2	42	43	1	1	-	-	-	-
47282	8981	2737.4	8	1	50	32	tr	8	1	-	-	-
47324	8982	2737.7	14	3	40	42	tr	1	-	-	-	-
47283	8983	2738.0	13	2	41	42	1	1	-	-	tr	-
47284	8984	2738.3	16	1	48	33	tr	2	-	-	-	tr ‡
47285	8985	2738.6	12	4	39	43	tr	2	-	-	-	-
47286	8986	2738.9	28	2	23	45	1	1	-	-	-	-
47287	8987	2739.2	25	2	27	44	tr	2	-	-	-	-

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite

Q. - Quartz
Oth. - Other minerals

Tr - Trace
∅ includes micrinite
‡ chalcopyrite

TABLE 3.5 (vi) (cont'd)

COOPER BASIN : FLY LAKE NO.1 WELL

MACERAL ANALYSES OF THE MALABINE COAL

(Results are given as percentages by volume unless otherwise stated)

Lab. No.	Depth Feet	Depth (m)	Vitri-nite	Exin-ite	Inert-odetr-inite∅	Semifus-inite	Fusin-ite	Mineral Matter				
								Cy.	Cb.	Py.	Q.	Oth.
47288	8988	2739.5	7	1	27	60	1	2	2	-	-	Tr ‡
47289	8989	2739.8	32	3	25	39	tr	1	-	-	-	-
47290	8990	2740.2	67	3	14	16	tr	-	-	-	-	-
47291	8991	2740.5	27	2	19	48	3	1	-	-	-	-
47292	8992	2740.8	23	5	29	39	2	2	-	-	-	-
47293	8993	2741.1	39	3	25	31	1	1	-	-	-	tr ‡
47294	8994	2741.4	58	3	7	31	1	-	-	-	-	-
47295	8995	2741.7	22	2	21	51	2	2	-	-	-	tr ‡
47296	8996	2742.0	30	6	32	29	1	2	-	-	-	-
47297	8997	2742.3	26	1	26	45	1	1	-	-	-	-
47298	8998	2742.6	10	6	61	22	tr	1	-	-	-	-
47299	8999	2742.9	11	3	45	37	1	3	-	-	-	-
43295	9000	2743.2	23	2	26	45	1	3	tr	tr	tr	-
47300	9000	2743.2	11	3	43	41	1	1	tr	-	-	tr
47301	9001	2743.5	19	3	36	39	1	2	-	-	tr	-
47302	9002	2743.8	17	1	30	47	1	4	-	tr	tr	-

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite

Q. - Quartz
Oth. - Other minerals

tr - Trace
∅ includies micrinite
‡ chalcopyrite

TABLE 3.5 (vi) (cont'd)

COOPER BASIN : FLY LAKE NO.1 WELL

MACERAL ANALYSES OF THE MALABINE COAL

(Results are given as percentages by volume unless otherwise stated)

Lab. No. Depth (Feet)	Depth (m)	Vitrinite	Exinite	Inertodetrinite∅	Semi-Fusinite	Fusinite	Mineral Matter				
							Cy.	Cb.	Py.	Q.	Oth.
47303 9003	2744.1	41	1	19	32	2	5	-	-	tr	-
47304 9004	2744.4	29	3	10	42	2	11	-	-	3	-
Seam average		22	3	34	37	1	3	tr	tr	tr	tr
Mineral - matter-free		23	3	35	38	1	-	-	-	-	-

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite
Q. - Quartz
Oth. - Other minerals
Tr. - Trace
∅ - includes micrinite

TABLE 3.5 (vii)

MACERAL ANALYSES OF COALS FROM FLY LAKE NO.1 WELL, COOPER BASIN

(Results are given as percentages by volume unless otherwise stated)

Lab. No. Depth (Feet)	Depth (m)	Vitrinite	Exinite	Inertodetrinite∅	Semi-Fusinite	Fusinite	Mineral Matter				
							Cy.	Cb.	Py.	Q.	Oth.
47305. 9322	2841.3	3	3	58	31	tr	3	-	tr	2	-
47306 9323	2841.7	13	4	29	47	3	3	-	-	1	-
43297 9323.5	2841.8	11	1	34	47	2	4	-	-	1	-
47307 9324	2842.0	5	1	54	20	-	10	-	1	9	-
47309 9326	2842.6	23	3	38	29	2	4	-	-	1	-
47310 9327	2842.9	7	2	39	45	1	4	-	-	2	-
Seam Average		10	2	42	37	1	5	-	tr	3	-
		11	2	46	40	1	-	-	-	-	-

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite
Q. - Quartz
Oth.- Other minerals
tr. - trace
∅ - includes micrinite

TABLE 3.6

MACERAL ANALYSES OF COALS FROM FLY LAKE NO. 2 WELL

COOPER BASIN

Analyses of the Subsections and Composites

	Lab. No.	Depth (feet)	Depth (m)	Vitr-inite	Exin-ite	Inert-odetr-inite∅	Semi-fus-inite	Fusin-ite	Mineral Matter				
									Cy.	Cb.	Py.	Q.	Oth.
1.	43304	8818	2687.7	69	4	5	14	tr	1	6	tr	1	-
	mineral-matter-free			75	4	6	15	tr	-	-	-	-	-
	46725	8845.5	2696.1	80	7	1	6	1	5	-	tr	-	-
	46726	8846	2696.3)	82	10	3	1	1	3	-	-	-	-
	43307	8846	2696.3)	50	11	17	20	1	1	-	tr	tr	-
2.	Seam average			71	9	7	9	1	3	-	tr	tr	-
	mineral-matter-free			74	9	7	9	1	-	-	-	-	-
3.	43308	8861	2700.8				Dirt band						
				66	tr	2	1	-	11	tr	tr	20	-
	mineral-matter-free			96	tr	3	1	-	-	-	-	-	-
	46727	8865.5	2702.2	55	4	4	13	3	4	-	tr	17	-
	46728	8866	2702.4	44	5	16	29	3	3	-	-	tr	-
	46729	8867	2702.7	29	3	37	19	2	9	-	-	1	-
4.	Seam average			43	4	19	20	3	5	-	tr	6	-
	mineral-matter-free			48	5	21	23	3	-	-	-	-	-
	46730	9016	2748.1	36	2	27	24	4	7	-	-	tr	-
	46731	9017	2748.4)	70	4	8	14	3	1	-	tr	-	-
	43313	9017	2748.4)	69	3	8	17	2	1	-	tr	tr	-
	46732	9018	2748.7				Dirt band						
				44	2	3	1	-	50	-	-	tr	-
	46733	9019	2749.0	52	3	13	19	5	8	-	-	tr	-
	46734	9020	2749.3				Dirt band						
				53	4	2	-	tr	4	-	tr	tr	-
5.	Seam average excluding dirt bands			57	3	14	19	3	4	-	tr	tr	-
	mineral-matter-free			59	3	15	20	3	-	-	-	-	-
	46735	9203	2805.1	22	tr	10	51	8	9	-	tr	-	-
	46736	9204	2805.4	19	4	30	34	6	7	-	-	tr	-
	46737	9205	2805.7	50	1	11	29	8	1	-	-	tr	-
	46738	9206	2806.0)	17	1	20	52	7	3	-	-	-	-
	43317	9206	2806.0)	44	1	6	27	4	10	tr	-	[illegible]	tr
	46739	9207	2806.3	14	3	23	50	7	3	-	-	tr	-

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite
Q. - Quartz
Oth. - Other minerals
∅ - includes micrinite

TABLE 3.6 (Cont'd)

MACERAL ANALYSES OF COALS FROM FLY LAKE NO. 2 WELL

COOPER BASIN

Analyses of the Subsections and Composites

	Lab. No.	Depth (feet)	Depth (m)	Vitrinite	Exinite	Inertodetrinite∅	Semifusinite	Fusinite	Mineral Matter				
									Cy.	Cb.	Py.	Q.	Oth.
6.	Seam average			28	2	17	40	7	5	tr	tr	1	-
	mineral-matter-free			30	2	18	43	7	-	-	-	-	-
7.	46740	9246	2812.2	18	4	45	27	3	2	-	tr	1	-
	mineral-matter-free			19	4	46	28	3	-	-	-	-	-
8.	46742	9256	2821.2	79	5	6	7	2	tr	1	tr	-	-
	mineral-matter-free			80	5	6	7	2	-	-	-	-	-
	46744	9256	2821.2	11	3	47	37	1	1	-	tr	tr	-
	46745	9257	2821.5	18	5	25	48	1	2	-	-	1	-
	46746	9258	2821.8	21	8	31	28	1	10	-	tr	1	-
	46747	9259	2822.1	14	1	35	43	3	4	-	-	tr	-
9.	Seam average			16	4	35	39	1	4	-	tr	1	-
	mineral-matter-free			17	4	37	41	1	-	-	-	-	-
10.	43323	9289	2831.3				Dirt band						
				30	1	5	10	1	13	-	tr	40	tr
	mineral-matter-free			64	2	11	21	2	-	-	-	-	-
11.	43324	9301	2834.5	34	4	31	25	3	1	1	-	1	-
	mineral-matter-free			35	4	32	26	3	-	-	-	-	-
12.	43325	9316	2839.5	75	5	8	8	3	1	-	tr	tr	-
	mineral-matter-free			76	5	8	8	3	-	-	-	-	-
13.	43328	9482	2890.1	47	5	20	21	3	3	-	-	1	-
	mineral-matter-free			49	5	21	22	3	-	-	-	-	-
	46748	9486	2891.3	19	1	34	36	7	2	-	tr	1	-
	43330	9487	2891.6)	49	2	15	28	2	2	-	-	2	-
	46749	9487	2891.6)	42	1	17	31	5	3	-	-	1	-
	46750	9488	2891.9	39	3	30	18	7	2	-	-	1	-
	46751	9489	2892.2	32	2	15	37	4	10	-	-	tr	-
	46752	9489.5	2892.4	29	1	15	18	8	27	2	tr	tr	-
14.	Seam average			35	2	21	28	5	8	tr	tr	1	-
	mineral-matter-free			39	2	23	31	5	-	-	-	-	-
15.	43333	9514	2899.9	14	2	43	35	1	3	-	-	2	-
	mineral-matter-free			15	2	45	37	1	-	-	-	-	-
	46753	9521	2902.0	14	3	44	27	2	8	-	tr	2	-
	46754	9522	2902.3	8	1	64	14	1	10	-	tr	2	-
16.	Seam average			11	1	54	21	1	9	-	tr	2	-
	mineral-matter-free			12	2	61	24	1	-	-	-	-	-
17.	43334	9526	2903.5				Dirt band						
				11	2	16	15	2	2	-	tr	52	-
	mineral-matter-free			24	4	35	33	4	-	-	-	-	-
	46755	9573.5	2918.0	22	-	12	24	2	38	-	-	2	-
	46756	9574)	2918.2	34	tr	10	17	4	31	tr	tr	4	-
	43337	9574)	2918.2	47	1	16	19	2	7	tr	-	8	-
18.	Seam average			34	tr	13	20	3	25	tr	tr	5	-
	mineral-matter-free			49	tr	18	29	4	-	-	-	-	-

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite
Q. - Quartz
Oth. - Other minerals

∅ includes micrinite

TABLE 3.7

MACERAL ANALYSES OF COALS FROM FLY LAKE No.3 WELL

COOPER BASIN

(Results are given as percentages by volume unless otherwise stated)

	Lab. No.	Depth (feet)	Depth (m)	Vitrin-ite	Exin-ite	Inert-odetr-inite∅	Semi-fusi-nite	Fusi-nite	Mineral Matter				
									Cy.	Cb.	Py.	Q.	Oth.
1.	46759	8717	2656.9	64	6	3	10	1	15	tr	-	1	-
	mineral-matter-free			76	7	4	12	1	-	-	-	-	-
	46760	8725	2659.4	54	8	18	16	2	2	-	tr	-	-
	46761	8727	2660.0	30	9	36	21	1	2	-	tr	1	-
2.	Seam average			42	9	27	19	1	2	-	tr	tr	-
	mineral-matter-free			43	9	28	19	1	-	-	-	-	-
						Dirt band							
3.	46764	8743	2664.9	43	3	3	tr	-	50	tr	tr	1	-
	mineral-matter-free			88	6	6	tr	-	-	-	-	-	-
	46766	8759	2669.7	89	5	1	2	2	1	-	tr	-	-
	46767	8760	2670.0	73	9	2	3	1	12	-	tr	-	-
4.	Seam average			81	7	1	3	1	7	-	tr	-	-
	mineral-matter-free			87	8	1	3	1	-	-	-	-	-
5.	46771	8779.5	2676.0	65	9	2	22	2	tr	tr	tr	-	-
	mineral-matter-free			65	9	2	22	2	-	-	-	-	-
	46774	8796	2681.0	54	7	16	21	1	1	-	tr	tr	-
	46775	8797	2681.3	30	2	15	45	2	6	-	tr	tr	-
	46777	8798	2681.6	22	6	35	34	2	1	tr	tr	tr	-
	46778	8799	2681.9	44	4	14	35	2	1	-	-	tr	-
	46779	8800	2682.2	17	5	43	28	2	4	-	tr	1	-
	46780	8801	2682.5	28	5	19	39	4	5	-	tr	tr	-
6.	Seam average			32	5	24	34	2	3	tr	tr	tr	-
	mineral-matter-free			33	5	25	35	2	-	-	-	-	-
	46784	9204	2805.4	45	3	13	23	2	11	-	tr	3	-
	46785	9205	2805.7	46	2	8	34	6	4	tr	tr	tr	-
	46786	9206	2806.0	70	6	6	16	1	1	-	tr	-	-
7.	Seam average			54	4	9	24	3	5	tr	tr	1	-
	mineral-matter-free			57	4	10	26	3	-	-	-	-	-
8.	46792	9319	2840.4	46	6	13	14	7	10	4	tr	tr	-
	mineral-matter-free			54	7	15	16	8	-	-	-	-	-
	46797	9343	2847.7	7	2	49	35	1	5	tr	-	1	-
	46798	9346	2848.7	65	6	12	10	5	2	tr	-	tr	-
9.	Seam average			36	4	31	22	3	3	tr	-	1	-
	mineral-matter-free			38	4	32	23	3	-	-	-	-	-

Cy. - Clay

Cb. - Carbonate

Py. - Pyrite

Q. - Quartz

tr - Trace

∅ - includes micrinite

TABLE 3.7 (Cont'd)

MACERAL ANALYSES OF COALS FROM FLY LAKE NO.3 WELL

COOPER BASIN

(Results are given as percentages by volume unless otherwise stated)

	Lab. No.	Depth (feet)	Depth (m)	Vitrinite	Exinite	Inertodetrinite∅	Semifusinite	Fusinite	Mineral Matter				
									Cy.	Cb.	Py.	Q.	Oth.
10.	46850	9365	2854.5	15	9	33	31	5	6	-	-	1	-
	mineral-matter-free			16	10	36	33	5	-	-	-	-	-
11.	46802	9373	2856.9	65	4	5	16	7	1	2	tr	-	-
	mineral-matter-free			67	4	5	17	7	-	-	-	-	-
						Dirt band							
	46804	9427	2873.3	55	tr	2	-	-	1	42	tr	tr	-
	46805	9429	2874.0	20	2	40	21	3	13	-	-	1	-
	46806	9430	2874.3	58	tr	3	5	4	27	3	tr	-	-
12.	Seam average (excluding dirt band)			39	1	22	13	3	20	2	tr	tr	-
	mineral-matter-free			50	1	28	17	4	-	-	-	-	-
13.	46808	9440	2887.3	11	2	46	22	1	16	-	tr	2	-
	mineral-matter-free			13	3	56	27	1	-	-	-	-	-
14.	46815	9473	2887.4	32	3	30	27	6	2	-	-	-	-
	mineral-matter-free			33	3	31	27	6	-	-	-	-	-
	46820	9507	2897.7	50	3	9	8	4	26	-	tr	-	-
	46821	9508	2898.0	24	3	21	30	5	16	-	-	1	-
						Dirt band							
	46822	9509	2898.3	33	1	tr	12	4	47	tr	-	3	-
15.	Seam average (excluding dirt band)			37	3	15	19	4	21	-	tr	1	-
	mineral-matter-free)			48	4	19	24	5	-	-	-	-	-
16.	46825	9519	2901.4	32	2	23	35	4	3	-	-	1	-
	mineral-matter-free			33	2	24	37	4	-	-	-	-	-
	46828	9526	2903.5	46	2	22	24	4	1	-	tr	1	-
	46829	9527	2903.8	21	5	34	33	3	3	-	-	1	-
	46830	9528	2904.1	55	2	11	17	3	10	tr	tr	1	-
	46831	9529	2904.4	42	4	16	29	5	3	-	-	1	-
	46832	9530	2904.7	22	3	30	31	8	6	tr	tr	tr	-
17.	Seam average			37	3	23	27	4	5	tr	tr	1	-
	mineral-matter-free			39	3	25	29	4	-	-	-	-	-

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite
Q. - Quartz
tr - Trace
∅ - includes micrinite

TABLE 3.7 (cont'd)

MACERAL ANALYSES OF COALS FROM FLY LAKE NO.3 WELL, COOPER BASIN

(Results are given as percentages by volume unless otherwise stated)

	Lab. No.	Depth Feet	Depth (m)	Vitrinite	Exinite	Inertodetrinite∅	Semifusinite	Fusinite	Mineral matter			
									Cy.	Cb.	Py.	Q.
	46837	9543	2908.7	1	1	44	30	tr	9	8	-	7
	46838	9544	2909.0	44	6	15	15	5	7	tr	tr	8
	46839	9545	2909.3	4	2	45	32	1	13	tr	tr	3
				Dirt Band								
	46840	9546	2909.6	25	-	1	8	1	64	-	tr	1
18.	Seam average (excluding dirt band) mineral-matter-free			16 19	3 4	35 43	26 32	2 2	10 -	2 -	tr -	6 -
	46845	9577	2919.1	46	1	25	4	1	10	-	-	13
	46846	9578	2919.4	40	2	21	14	2	16	-	tr	5
				Dirt Band								
	46848	9580	2920.0	28	-	5	15	7	36	1	tr	8
19.	Seam average (excluding dirt band) mineral-matter-free			43 55	1 1	23 29	9 12	2 3	13 -	- -	tr -	9 -

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite
Q. - Quartz.
tr. - Trace
∅ - includes micrinite

TABLE 3.8

MACERAL ANALYSES OF COALS FROM BROLGA NO. 1 WELL

COOPER BASIN

Lab. No.	Depth (feet)	Depth (m)	Vitrinite	Exinite	Inertodetrinite	Semifusinite	Fusinite	Mineral matter Cy.	Cb.	Py.	Q.	Oth.
47151	8937	2724.0	83	8	3	4	1	1	-	tr	-	-
mineral-matter-free			84	8	3	4	1	-	-	-	-	-
47159	9243	2817.3	10	tr	49	35	3	2	-	-	1	-
47160	9244.5	2817.7	7	3	50	31	2	5	-	-	2	-
47161	9246	2818.2	44	1	19	34	1	1	tr	tr	tr	-
47187	9247.5	2818.6	27	3	12	30	4	22	-	-	2	-
47162	9249	2819.0	16	1	34	44	2	3	-	-	tr	-
47163	9250	2819.4	25	2	16	50	3	4	-	tr	-	-
47164	9251	2819.7	31	1	17	45	4	2	-	-	-	-
	seam average		23	2	28	38	3	5	tr	tr	1	-
mineral-matter-free			25	2	30	40	3	-	-	-	-	-
47166	9258	2821.8	31	5	23	37	3	1	-	-	-	-
mineral-matter-free			31	5	23	38	3	-	-	-	-	-
47170	9274	2826.7	9	2	49	34	3	2	-	-	1	-
47171	9275	2827.0	12	1	36	45	3	3	-	tr	tr	-
47172	9277	2827.6	3	3	63	22	3	2	-	-	4	-
47173	9278	2827.9	26	2	29	39	2	1	-	-	1	-
47174	9280	2828.5	12	1	16	68	1	1	-	-	1	-
47175	9281	2828.8	33	1	6	10	3	44	-	-	3	-
47176	9283	2829.5	14	1	13	27	7	34	-	tr	4	-
47177	9284	2829.8	60	3	7	23	6	1	-	tr	tr	-
47178	9286	2830.4	15	3	34	23	1	23	-	-	1	-
‡ seam average			21	2	28	32	3	12	-	tr	2	-
‡ Clean coal composite excluding 9681'			19	2	31	35	3	8	-	tr	2	-
mineral-matter-free			21	2	35	39	3	-	-	-	-	-
47179	9290.5	2831.7	45	1	17	6	4	26	-	tr	1	-
mineral-matter-free			62	1	23	8	6	-	-	-	-	-
47182	9327	2842.9	32	3	12	44	6	3	-	tr	tr	-
mineral-matter-free			33	3	12	46	6	-	-	-	-	-
47183	9331	2844.1	16	2	37	36	5	4	-	tr	tr	-
mineral-matter-free			17	2	38	38	5	-	-	-	-	-
47194	9573	2917.9	46	1	27	16	4	4	-	-	2	-
mineral-matter-free			49	1	29	17	4	-	-	-	-	-
47198	9598	2925.5	26	1	34	24	7	6	-	-	2	tr
47200	9602.5	2926.8	38	-	-	2	tr	59	tr	1	-	-
Ø seam average			32	tr	17	13	4	33	tr	tr	1	tr
Ø Clean coal composite exclud-9602.5'			26	1	34	24	7	6	-	-	2	tr
mineral-matter-free			28	1	37	26	8	-	-	-	-	-
47202	9621.75	2932.7	22	1	32	13	3	25	tr	tr	4	-
mineral-matter-free			31	2	45	18	4	-	-	-	-	-
47204	9630	2935.2	57	1	4	21	6	10	-	-	1	-
mineral-matter-free			64	1	4	24	7	-	-	-	-	-

Cy. - Clay; Cb. - Carbonate; Py. - Pyrite; tr - trace; Q. - Quartz; ‡ - Sphalerite; Oth. - Other minerals

TABLE 3.9 (i)

MICROLITHOTYPE ANALYSES OF COALS FROM FLY LAKE NO.1 WELL, COOPER BASIN

(Results are given as percentages by volume unless otherwise stated)

Lab.No.	Depth Feet	Depth (m)	Vitr-ite	Clar-ite	Inter-med-iates ‡	Micr-oite Ø	Semi-fus-ite	Shaly Coal	Mineral Matter				
									Cy.	Cb.	Py.	Q.	Oth.
43280	8446.5	2574.5	1	-	15	59	24	1	tr	-	-	tr	-
47209			tr	-	25	44	26	4	1	-	-	-	-
47210	8447.5	2574.8	6	-	28	27	37	2	tr	-	-	-	-
47211	8448.5	2575.1	11	-	49	3	36	1	tr	tr	-	-	-
47212	8449.5	2575.4	19	2	32	2	22	10	13	-	tr	tr	-
47213	8450.5	2575.7	33	1	44	-	19	2	1	-	-	-	-
47214	8451.5	2576.0	41	tr	42	1	14	1	1	-	-	-	-
47215	8452.5	2576.3	1	-	22	36	38	2	1	-	-	tr	-
47216	8453.5	2576.6	4	-	46	17	32	1	tr	-	-	-	-
47217	8454.5	2576.9	15	-	55	4	23	2	1	-	-	tr	-
47218	8455.5	2577.2	38	-	20	20	19	3	tr	tr	-	-	-
47219	8456.5	2577.5	7	-	18	49	25	1	tr	-	-	tr	-
1.	Seam average		15	tr	33	22	26	3	1	tr	tr	tr	-
	Mineral matter-free		16	tr	34	23	27	-	-	-	-	-	-

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite

Q. - Quartz
Oth. - Other minerals

‡ comprises duroclarite clarodurite vitrinertite

Ø includes durite

TABLE 3.9 (ii)

MICROLITHOTYPE ANALYSES OF COALS FROM FLY LAKE NO.1 WELL, COOPER BASIN

(Results are given as percentages by volume unless otherwise stated)

Lab.No.	Depth Feet	Depth (m)	Vitrite	Clarite	Intermediates †	Microite ∅	Semifusite	Shaly Coal	Mineral Matter				
									Cy.	Cb.	Py.	Q.	Oth.
47220	8471.5	2582.1	13	-	45	15	26	1	tr	-	-	tr	-
47221	8472.5	2582.4	2	-	18	51	28	1	tr	-	-	tr	-
47222	8473.5	2582.7	2	-	16	65	15	2	tr	-	-	tr	-
47223	8474.5	2588.0	6	-	15	45	32	1	tr	-	-	1	-
47224	8475.5	2583.3	2	-	11	61	23	2	tr	-	-	1	-
43283	8476	2583.5	3	-	20	36	38	1	1	-	-	1	-
47225	8476.5	2583.6	4	-	19	44	29	3	1	-	-	tr	-
47226	8477.5	2583.9	7	tr	40	23	28	1	1	-	-	-	-
47227	8478.5	2584.2	24	1	49	2	22	1	1	-	-	tr	-
							DIRT BAND						
47228	8479.5	2584.6	18	-	8	-	7	29	36	-	-	1	-
2.	Seam Average	excluding dirt band	7	tr	26	38	27	1	1	-	-	tr	
	Mineral matter-free		7	tr	26	39	28	-	-	-	-	-	

Cy. - Clay

Cb. - Carbonate

Py. - Pyrite

Q. - Quartz

Oth.- Other minerals

† comprises duroclarite, clarodurite, vitrinertite

∅ includes durite

TABLE 3.9 (iii)

MICROLITHOTYPE ANALYSES OF COALS FROM FLY LAKE NO.1 WELL, COOPER BASIN

(Results are given as percentages by volume unless otherwise stated)

Lab.No.	Depth Feet	Depth (m)	Vitrite	Clarite	Intermediates †	Microite ∅	Semifusite	Shaly Coal	Mineral Matter				
									Cy.	Cb.	Py.	Q.	Oth.
47229	8801.5	2682.7	11	1	67	1	19	-	tr	-	-	1	-
47230	8802	2682.8	57	6	2	1	4	9	21	-	-	-	-
47231	8804	2683.5	2	-	46	18	32	1	1	-	-	-	-
43286	8805	2683.8	22	5	46	2	24	tr	1	-	tr	tr	-
47232	8805.5	2683.9	2	-	51	23	22	1	1	-	-	-	-
47233	8806.5	2684.2	tr	-	26	56	16	1	1	-	-	tr	-
47234	8807.5	2684.5	5	tr	57	15	21	1	1	-	-	tr	-
47235	8808.5	2684.8	46	21	16	-	6	3	8	-	-	-	-
3.	Seam average		18	4	39	15	18	2	4	-	tr	tr	-
	Mineral matter-free		19	4	42	16	19	-	-	-	-	-	-

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite

Q. - Quartz
Oth.- Other minerals

† comprises duroclarite, clarodurite, vitrinertite

∅ includes durite

TABLE 3.9 (iv)

MICROLITHOTYPE ANALYSES OF COALS FROM FLY LAKE NO.1 WELL, COOPER BASIN

(Results are given as percentages by volume unless otherwise stated)

Lab.No.	Depth Feet	Depth (m)	Vitrite	Clarite	Intermediates ‡	Microite Ø	Semifusite	Shaly Coal	Mineral Matter Cy.	Cb.	Py.	Q.	Oth.
47236	8828	2690.8	9	-	61	5	24	1	tr	-	-	-	-
47237	8829	2691.1	48	13	1	-	3	16	18	-	-	1	-
DIRT BAND													
47238	8830	2691.4	38	4	-	-	-	12	45	-	-	1	-
47239	8831	2691.7	42	tr	31	1	26	tr	tr	-	-	-	-
47240	8833	2692.3	26	1	37	1	35	tr	tr	-	-	-	-
4.	Seam excluding average dirt band		31	4	32	2	22	4	5	-	-	tr	-
	Mineral matter-free		34	5	35	2	24	-	-	-	-	-	-

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite

Q. Quartz
Oth. Other minerals

‡ comprises duroclarite, clarodurite, vitrinertite

Ø includes durite

TABLE 3.9 (v)

MICROLITHOTYPE ANALYSES OF COALS FROM FLY LAKE NO.1 WELL, COOPER BASIN

(Results are given as percentages by volume unless otherwise stated)

Lab.No.	Depth Feet	Depth (m)	Vitrite	Clarite	Intermediates †	Microite Ø	Semifusite	Shaly Coal	Mineral Matter				
									Cy.	Cb.	Py.	Q.	Oth.
47241	8850	2697.5	28	3	31	5	32	1	tr	-	-	-	-
47242	8851	2697.8	-	-	8	90	tr	2	tr	-	-	-	-
47243	8852	2698.1	1	-	8	77	7	4	1	2	-	tr	-
43291	8853	2698.4	tr	-	23	69	3	2	tr	2	tr	1	-
47244	8853	2698.4	tr	-	9	68	18	4	1	tr	-	tr	-
47245	8854	2698.7	2	tr	44	14	36	4	tr	-	-	tr	-
47246	8855	2699.0	5	-	29	25	39	1	tr	1	tr	tr	-
47247	8856	2699.3	41	45	10	-	3	1	tr	-	-	-	-
47248	8857	2699.6	48	1	22	tr	25	4	tr	-	-	-	-
47249	8858	2699.9	27	3	46	3	20	1	tr	-	-	-	-
47250	8859	2700.2	-	-	4	89	2	3	2	tr	-	tr	-
47251	8860	2700.5	-	-	3	95	-	1	1	tr	-	tr	-
47252	8861	2700.8	1	-	14	58	26	1	tr	-	-	tr	-
47253	8862	2701.1	25	tr	44	1	29	tr	1	-	-	tr	-
47254	8863	2701.4	1	-	5	73	7	10	4	-	-	tr	-
47255	8864	2701.7	-	-	4	95	tr	1	tr	-	-	tr	-
47256	8865	2702.1	24	tr	39	1	34	tr	2	-	-	tr	-
5. Seam average			12	3	20	45	17	2	1	tr	tr	tr	-
Mineral matter-free			12	3	21	46	18	-	-	-	-	-	-

Cy. Clay. Cb. Carbonate. Py. Pyrite. Q. Quartz. Oth. - Other minerals. Ø includes durite

† comprises duroclarite, clarodurite, vitrinertite

TABLE 3.9 (vi)

MICROLITHOTYPE ANALYSES OF COALS FROM FLY LAKE NO.1 WELL, COOPER BASIN

MALABINE COAL

(Results are given as percentages by volume unless otherwise stated)

Lab.No.	Depth Feet	Depth (m)	Vitrite	Clarite	Intermediates ‡	Micrite Ø	Semifusite	Shaly Coal	Mineral Matter				
									Cy.	Cb.	Py.	Q.	Oth.
47257	8956	2729.8	5	tr	16	39	38	1	tr	1	-	-	-
47258	8957	2730.1	4	-	14	44	37	1	-	-	-	-	-
47259	8958	2730.4	1	-	16	42	36	5	tr	-	-	-	-
47260	8959	2730.7	tr	-	18	57	16	6	3	-	-	-	-
47261	8960	2731.0	-	-	1	82	8	6	3	-	-	-	-
47262	8961	2731.3	1	-	14	59	22	3	1	-	-	-	-
47263	8962	2731.6	14	3	39	13	22	7	2	-	-	-	-
47264	8963	2731.9	7	1	64	7	19	1	1	-	-	-	-
47265	8964	2732.2	3	-	24	24	48	1	tr	-	-	-	-
47266	8965	2732.5	30	12	38	3	16	1	tr	-	-	-	-
47267	8966	2732.8	5	-	12	26	55	1	1	-	-	-	-
47268	8967	2733.1	6	-	27	28	37	2	-	-	-	-	-
47269	8968	2733.4	tr	-	2	80	17	1	-	-	-	-	-
47270	8969	2733.8	-	-	10	59	30	1	1	-	-	tr	-
47271	8970	2734.1	42	1	32	1	21	3	tr	-	-	-	-
47272	8971	2734.4	42	2	36	3	11	4	2	-	-	-	-

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite
Q. - Quartz
Oth. - Other minerals
tr - Trace
Ø - includes durite

‡ comprises duroclarite, clarodurite, vitrinertite

TABLE 3.9 (vi) (Cont'd)

MICROLITHOTYPE ANALYSES OF COALS FROM FLY LAKE NO.1 WELL, COOPER BASIN

(Results are given as percentages by volume unless otherwise stated)

Lab.No.	Depth Feet	Depth (m)	Vitr-ite	Clar-ite	Inter-med-iates †	Micr-oite ∅	Semi-fus-ite	Shaly Coal	Mineral Matter				
									Cy.	Cb.	Py.	Q.	Oth.
47273	8972	2734.7	15	1	35	10	38	1	tr	-	-	-	-
47274	8973	2735.0	29	4	37	3	18	2	7	-	-	tr	-
47275	8974	2735.3	6	2	45	11	33	3	tr	tr	-	-	-
47276	8975	2735.6	-	-	11	59	29	1	tr	-	-	-	-
47277	8976	2735.9	11	-	24	11	52	1	1	-	-	-	-
47278	8977	2736.2	tr	-	3	65	30	1	1	tr	-	-	-
47279	8978	2736.5	-	-	1	80	9	8	1	1	-	-	-
47280	8979	2736.8	2	-	45	20	32	tr	1	-	-	-	-
47281	8980	2737.1	1	-	26	36	36	tr	1	-	-	-	-
47282	8981	2737.4	tr	-	19	39	36	4	1	1	-	-	-
47324	8982	2737.7	2	-	33	29	35	tr	1	-	-	-	-
47283	8983	2738.0	tr	-	32	27	39	1	1	-	-	-	-
47284	8984	2738.3	3	-	32	38	25	1	1	-	-	-	-
47285	8985	2738.6	1	-	30	33	36	tr	tr	-	-	-	-
47286	8986	2738.9	7	tr	45	10	37	tr	1	-	-	-	-
47287	8987	2739.2	14	-	26	12	47	1	tr	-	-	-	-

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite

Q. - Quartz.
Oth. - Other minerals

† comprises duroclarite, clarodurite, vitrinertite

tr - trace
∅ includes durite

TABLE 3.9 (vi) (Cont'd)

MICROLITHOTYPE ANALYSES OF COALS FROM FLY LAKE NO.1 WELL, COOPER BASIN

(Results are given as percentages by volume unless otherwise stated)

Lab.No.	Depth Feet	Depth (m)	Vitr-ite	Clar-ite	Inter-med-iates †	Micr-oite Ø	Semi-fus-ite	Shaly Coal	Mineral Matter				
									Cy.	Cb.	Py.	Q.	Oth.
47288	8988	2739.5	2	-	10	22	60	5	1	tr	-	-	-
47289	8989	2739.8	8	tr	52	6	33	tr	1	tr	-	-	-
47290	8990	2740.2	44	tr	40	3	12	-	1	-	-	-	-
47291	8991	2740.5	11	-	42	5	41	tr	1	-	-	-	-
47292	8992	2740.8	7	-	32	27	32	1	1	-	-	-	-
47293	8993	2741.1	17	tr	52	6	25	tr	-	-	-	-	
47294	8994	2741.4	44	tr	38	-	17	tr	1	-	-	-	-
47295	8995	2741.7	8	-	37	11	42	1	1	-	-	-	
47296	8996	2742.0	7	3	55	13	21	tr	1	-	-	-	-
47297	8997	2742.3	4	-	58	5	33	tr	tr	-	-	-	-
47298	8998	2742.6	1	-	17	64	17	tr	1	-	-	-	-
47299	8999	2742.9	1	tr	26	48	21	3	1	-	-	-	-
43295	9000	2743.2	2	1	54	5	35	1	2	tr	tr	tr	-
47300	9000		2	-	26	39	32	-	1	-	-	-	-
47301	9001	2743.5	5	1	45	15	30	3	1	-	-	-	-
47302	9002	2743.8	1	-	24	32	39	2	-	-	-	-	-

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite

Q. - Quartz
Oth.- Other minerals

† comprises duroclarite, clarodurite, vitrinertite

tr trace
Ø includes durite

TABLE 3.9 (vi.) (Cont'd)

MICROLITHOTYPE ANALYSES OF COALS FROM FLY LAKE NO.1 WELL, COOPER BASIN

(Results are given as percentages by volume unless otherwise stated)

Lab.No.	Depth Feet	Depth (m)	Vitrite	Clarite	Intermediates ‡	Microite ∅	Semifusite	Shaly Coal	Mineral Matter Cy.	Cb.	Py.	Q.	Oth.
47303	9003	2744.1	31	tr	36	2	29	1	1	-	-	-	-
47304	9004	2744.4	18	2	25	3	41	4	5	-	-	2	-
Seam average			9	1	29	27	31	2	1	tr	tr	tr	tr
mineral-matter-free			9	1	30	28	32	-	-	-	-	-	-

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite
Q. - Quartz
Oth. - Other minerals

‡ comprises duroclarite, clarodurite, vitrinertite

tr - Trace
∅ - includes durite

TABLE 3.9 (vii)

MICROLITHOTYPE ANALYSES OF COALS FROM FLY LAKE NO.1 WELL, COOPER BASIN

(Results are given as percentages by volume unless otherwise stated)

Lab.No.	Depth Feet	Depth (m)	Vitrite	Clarite	Intermediates ‡	Micrite Ø	Semifusite	Shaly Coal	Mineral Matter				
									Cy.	Cb.	Py.	Q.	Oth.
47305	9322	2841.3	-	-	3	75	19	2	tr	-	-	1	-
47306	9323	2841.7	2	-	18	44	33	2	1	-	-	tr	-
43297	9323.5	2841.8	3	tr	27	27	41	1	1	-	-	tr	-
47307	9324	2842.0	tr	-	3	53	13	26	1	-	-	4	-
47309	9326	2842.6	4	1	46	25	19	3	1	-	-	1	-
47310	9327	2842.9	-	tr	19	44	34	2	1	-	-	tr	-
Seam Average			1	tr	19	45	27	6	1	-	-	1	-
mineral-matter-free			1	tr	21	49	29	-	-	-	-	-	-

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite

Q. - Quartz
Oth.- Other minerals

tr - trace
Ø - includes durite

‡ comprises duroclarite, clarodurite, vitrinertite

TABLE 3.10

MICROLITHOTYPE ANALYSES OF COALS FROM FLY LAKE NO.2 WELL
COOPER BASIN

	Lab. No.	Depth (feet)	Depth (m)	Vitrite	Clarite	Intermediates ‡	Microite Ø	Semifusite *	Shaly Coal	Mineral Matter Cy.	Mineral Matter Cb.	Mineral Matter Py.	Mineral Matter Q.
1.	43304	8818	2687.7	61	8	16	-	8	tr	tr	6	tr	1
	mineral-matter-free			65	9	17	-	9	-	-	-	-	-
	46725	8845.5	2696.1	72	10	6	-	6	4	2	-	tr	tr
	46726	8846	2696.3)	61	32	4	-	2	1	-	-	-	-
	43307	8846	2696.3)	23	2	60	2	13	-	tr	-	tr	tr
	Seam average			52	15	23	1	7	2	tr	-	tr	tr
2.	mineral-matter-free			53	15	24	1	7	-	-	-	-	-
	43308	8861	2700.8	55	2	1	-	tr	10	7	1	tr	24
3.	mineral-matter-free			95	4	1	-	tr	-	-	-	-	-
	46727	8865.5	2702.2	37	5	22	1	11	1	3	-	-	20
	46728	8866	2702.4	25	1	45	7	18	1	3	-	-	-
	46729	8867	2702.7	3	-	66	10	10	2	8	-	-	1
	Seam average			22	2	44	6	13	1	5	-	-	7
4.	mineral-matter-free			25	2	51	7	15	-	-	-	-	-
	46730	9016	2748.1	14	1	44	13	21	1	5	-	-	1
	46731	9017	2748.4)	52	2	34	-	12	-	-	-	-	-
	43313	9017	2748.4)	52	1	33	tr	12	2	tr	-	tr	tr
	46732	9018	2748.7				Dirt Band						
				24	4	2	-	2	25	43	-	-	tr
	46733	9019	2749.0	32	-	46	-	15	1	6	-	-	-
	46734	9020	2749.3				Dirt Band						
				42	8	tr	-	tr	13	37	-	-	-
	Seam (excluding dirt bands) average			38	1	39	3	15	1	3	-	tr	tr
5.	mineral-matter-free			40	1	41	3	15	-	-	-	-	-
	46735	9203	2805.1	8	1	27	2	58	2	2	-	tr	tr
	46736	9204	2805.4	3	-	58	8	26	4	1	-	-	tr
	46737	9205	2805.7	29	1	40	tr	29	tr	1	-	-	-
	46738	9206	2806.0)	3	-	29	13	55	tr	tr	-	-	-
	43317	9206	2806.0)	39	1	14	2	23	5	4	tr	tr	12
	46739	9207	2806.3	2	-	26	17	55	tr	tr	-	-	-

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite

Q. - Quartz
‡ - Comprises duroclarite, clarodurite, vitrinertite

Ø - includes durite
* - includes fusite

TABLE 3.10 (Cont'd)

MICROLITHOTYPE ANALYSES OF COALS FROM FLY LAKE NO.2 WELL

COOPER BASIN

	Lab. No.	Depth (feet)	Depth (m)	Vitrite	Clarite	Intermediates ‡	Microite Ø	Semifusite *	Shaly Coal	Mineral Matter Cy.	Cb.	Py.	Q.
6.	Seam average			14	1	32	7	41	2	1	tr	tr	2
	mineral-matter-free			15	1	34	7	43	-	-	-	-	-
7.	46740	9246	2818.2	tr	-	45	32	22	1	-	-	-	tr
	mineral-matter-free			tr	-	46	32	22	-	-	-	-	-
8.	46742	9249	2819.1	53	23	15	-	9	-	-	tr	-	-
	mineral-matter-free			53	23	15	-	9	-	-	-	-	-
	46744	9256	2821.2	1	tr	24	44	29	1	1	-	-	tr
	46745	9257	2821.5	2	-	46	16	32	2	2	-	-	tr
	46746	9258	2821.8	3	tr	42	27	20	7	1	-	tr	tr
	46747	9259	2822.1	4	-	16	35	42	2	1	-	tr	tr
9.	Seam average			2	tr	32	31	31	3	1	-	tr	tr
	mineral-matter-free			2	tr	34	32	32	-	-	-	-	-
10.						Dirt band							
	43323	9289	2831.3	18	1	15	1	10	7	2	-	-	46
	mineral-matter-free			40	2	33	2	23	-	-	-	-	-
11.	43324	9301	2834.9	23	5	32	21	19	tr	tr	tr	-	tr
	mineral-matter-free			23	5	32	21	19	-	-	-	-	-
12.	43325	9316	2839.5	48	16	29	tr	7	tr	tr	-	tr	tr
	mineral-matter-free			48	16	29	tr	7	-	-	-	-	-
13.	43328	9482	2890.1	26	10	42	4	14	3	1	-	tr	tr
	mineral-matter-free			27	10	44	4	15	-	-	-	-	-
	46748	9486	2891.3	7	1	32	27	31	2	-	-	-	tr
	43330	9487	2891.6)	27	2	42	7	20	1	1	-	-	tr
	46749	9487	2891.6)	22	tr	50	1	26	tr	1	-	-	tr
	46750	9488	2891.9	11	tr	72	3	13	1	-	-	-	tr
	46751	8489	2892.2	15	-	34	1	30	14	6	-	-	-
	46752	9489.5	2892.4	15	-	36	1	17	12	16	3	-	-
14.	Seam average			16	tr	44	7	23	5	4	1	-	-
	mineral-matter-free			18	tr	49	8	25	-	-	-	-	-
15.	43333	9514	2899.9	3	-	47	18	28	3	tr	-	-	1
	mineral-matter-free			3	-	49	19	29	-	-	-	-	-
	46753	9521	2902.0	1	-	40	24	26	8	tr	-	-	1
	46754	9522	2902.3	tr	-	18	67	9	4	1	-	-	1
16.	Seam average			tr	-	29	46	17	6	1	-	-	1
	mineral-matter-free			tr	-	32	50	18	-	-	-	-	-
17.						Dirt band							
	43334	9526	2903.5	2	-	33	2	5	tr	tr	-	-	58
	mineral-matter-free			5	-	78	5	12	-	-	-	-	-
	46755	9573.5	2918.0	1	-	32	1	28	31	6	-	-	1
	43337	9574	2918.2)	15	1	24	-	16	32	8	1	-	3
	46756	9574	2918.2)	19	3	49	1	28	-	-	-	-	-
18.	Seam average			13	2	34	1	19	24	5	tr	-	2
	mineral-matter-free			19	3	49	1	28	-	-	-	-	-

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite

Q. - Quartz
‡ _ Comprises duroclarite
claroduite
vitrinertite

Ø - includes durite
* - includes fusite

TABLE 3.11

MICROLITHOTYPE ANALYSES OF COALS FROM FLY LAKE NO.3 WELL COOPER BASIN

(Results are given as percentages by volume unless otherwise stated)

Lab. No.	Depth (feet)	Depth (m)	Vitr-ite	Clar-ite	Inter-med-iates ɨ	Micr-oite ∅	Semi-fus-ite	Shaly Coal	Mineral Matter			
									Cy.	Cb.	Py.	Q.
46759	8717	2656.9	53	11	16	tr	6	9	5	tr	-	tr
1. Mineral-matter-free			62	13	18	tr	7	-	-	-	-	-
46760	8725	2659.4	31	8	48	3	10	tr	-	-	-	-
46761	8727	2660.0	8	1	62	16	13	tr	tr	-	-	tr
Seam average			20	4	55	9	12	tr	tr	-	-	tr
2. mineral-matter-free			20	4	55	9	12	-	-	-	-	-
46764	8743	2664.9	Dirt Band									
			32	7	tr	-	-	9	52	tr	-	-
3. mineral-matter-free			82	18	tr	-	-	-	-	-	-	-
46766	8759	2669.7	69	22	7	-	2	-	-	-	-	tr
46767	8760	2670.0	43	29	10	-	3	10	5	-	-	-
Seam average			56	26	9	-	2	5	2	-	-	tr
4. Mineral-matter-free			60	28	10	-	2	-	-	-	-	-
5. 46771	8779.5	2676.0	50	19	6	-	25	-	tr	tr	-	-
46774	8796	2681.0	26	2	56	2	14	tr	tr	-	tr	tr
46775	8797	2681.3	11	tr	42	5	40	2	tr	-	-	-
46777	8798	2681.6	2	tr	57	19	22	tr	-	tr	-	-
46778	8799	2681.9	22	1	50	4	23	tr	tr	-	-	tr
46779	8800	2682.2	2	tr	43	33	19	2	1	-	-	tr
46780	8801	2682.5	9	-	42	11	36	1	1	-	-	tr
Seam average			12	1	48	12	26	1	tr	tr	tr	tr
6. mineral-matter-free			12	1	49	12	26	-	-	-	-	-
46784	9204	2805.4	28	1	38	2	15	8	7	-	-	1
46785	9205	2805.7	28	3	32	-	33	2	1	tr	tr	-
46786	9206	2806.0	49	20	16	tr	14	1	tr	-	-	-
Seam average			35	8	29	tr	21	4	3	tr	tr	tr
7. mineral-matter-free			38	8	31	-	23	-	-	-	-	-
46792	9319	2840.4	18	4	51	1	13	7	2	4	tr	tr
8. mineral-matter-free			21	4	59	1	15	-	-	-	-	-
46797	9343	2847.7	tr	-	17	52	25	4	2	tr	-	tr
46798	9346	2848.7	29	11	50	-	8	1	tr	1	-	-
Seam average			15	5	34	26	16	3	1	tr	-	-
9. mineral-matter-free			16	5	35	27	17	-	-	-	-	-

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite
Q. - Quartz.

∅ - includes durite
tr - Trace
ɨ - comprises duroclarite
clarodurite
vitrinertite

TABLE 3.11 (cont'd)

MICROLITHOTYPE ANALYSES OF COALS FROM FLY LAKE NO.3 WELL COOPER BASIN
(Results are given as percentages by volume unless otherwise stated)

	Lab. No.	Depth (feet)	Depth (m)	Vitrite	Clarite	Intermediates †	Micrite Ø	Semifusite	Shaly Coal	Mineral Matter Cy.	Mineral Matter Cb.	Mineral Matter Py.	Mineral Matter Q.
	46850	9365	2854.5	2	-	40	33	20	4	1	-	-	-
10.	mineral-matter-free			2	-	42	35	21	-	-	-	-	-
	46802	9373	2856.9	46	11	22	-	18	1	tr	2	tr	tr
11.	mineral-matter-free			47	11	23	-	19	-	-	-	-	-
							Dirt Band						
	46804	9427	2873.3	53	-	tr	-	-	3	1	43	-	-
	46805	9429	2874.0	1	-	54	24	13	8	tr	-	-	-
	46806	9430	2874.3	49	1	3	1	10	12	20	4	tr	-
	Seam average (ex.dirt bd.)			25	tr	29	13	11	10	10	2	-	-
12.	mineral-matter-free			32	tr	37	17	14	-	-	-	-	-
	46808	9440	2877.3	3	-	24	51	14	7	tr	tr	-	1
13.	mineral-matter-free			3	-	26	56	15	-	-	-	-	-
	46815	9473	2887.4	6	5	57	5	26	1	-	-	tr	-
14.	mineral-matter-free			6	5	58	5	26	-	-	-	-	-
	46820	9507	2897.7	37	10	18	-	7	9	19	-	tr	-
	46831	9508	2898.0	10	-	36	3	29	9	13	-	-	tr
							Dirt Band						
	46822	9509	2898.3	35	tr	1	-	14	5	43	tr	-	2
	Seam average (ex.dirt bd.)			24	5	27	1	18	9	16	-	tr	tr
15.	mineral-matter-free			32	7	36	1	24	-	-	-	-	-
	46825	9519	2901.4	14	2	46	7	30	1	tr	-	-	-
16.	mineral-matter-free			14	2	47	7	30	-	-	-	-	-
	46828	9526	2903.5	25	2	48	3	20	1	tr	-	tr	1
	46829	9527	2903.8	6	-	47	18	25	2	2	-	-	tr
	46830	9528	2904.1	42	tr	26	2	18	5	7	tr	-	tr
	46831	9529	2904.4	13	3	56	2	25	1	tr	-	-	tr
	46832	9530	2904.7	4	tr	59	3	31	2	1	tr	-	-
	Seam average			18	1	47	6	24	2	2	tr	tr	tr
17.	mineral-matter-free			19	1	49	6	25	-	-	-	-	-
	46837	9543	2908.7	tr	-	3	52	19	14	1	8	-	3
	46838	9544	2909.0	17	9	40	2	13	7	4	1	-	7
	46839	9545	2909.3	-	-	14	46	27	9	3	tr	-	1
							Dirt Band						
	46840	9546	2909.6	17	-	tr	-	9	11	63	-	-	-
	Seam average (ex.dirt bd.)			6	3	19	33	20	10	3	3	-	3
18.	mineral-matter-free			7	4	23	41	25	-	-	-	-	-

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite
Q. - Quartz

Ø - includes durite
tr - Trace
† - comprises duroclarite
clarodurite
vitrinertite

TABLE 3.11 (cont'd)

MICROLITHOTYPE ANALYSES OF COALS FROM FLY LAKE NO.3 WELL

COOPER BASIN

(Results are given as percentages by volume unless otherwise stated)

Lab.No.	Depth (Feet)	Depth (m)	Vitr-ite	Clar-ite	Inter-med-iates ǂ	Micr-oite Ø	Semi-fus-ite	Shaly Coal	Mineral Matter			
									Cy.	Cb.	Py.	Q.
46845	9577	2919.1	8	1	56	tr	3	25	1	-	-	6
46846	9478	2919.4	12	tr	59	-	12	13	1	-	-	3
					Dirt Band							
46848	9580	2920.0	10	-	3	tr	19	37	23	1	-	7
Seam average (ex dirt bd)			10	tr	58	tr	7	19	1	-	-	5
19. mineral-matter-free			13	tr	78	-	9	-	-	-	-	-

Cy. - Clay

Cb. - Carbonate

Py. - Pyrite

Q. - Quartz

Ø - includes durite

tr.- Trace

ǂ - comprises duroclarite
clarodurite
vitrinertite

TABLE 3.12

MICROLITHOTYPE ANALYSES OF COALS FROM BROLGA NO.1 WELL

COOPER BASIN

Lab.No.	Depth (feet)	Depth (m)	Vitr-ite	Clar-ite	Inter-med-iates‡	Micr-oite ∅	Semi-fus-ite	Shaly Coal	Mineral Matter				
									Cy.	Cb.	Py.	Q.	Oth.
1. 47151	8937	2724.0	62	25	9	-	4	-	-	-	tr	-	-
47159	9243	2817.3	tr	-	27	42	28	1	2	-	-	-	-
47160	9244.5	2817.7	tr	-	24	45	27	2	1	-	tr	1	-
47161	9246	2818.2	31	1	28	7	32	tr	1	-	-	-	-
47187	9247.5	2818.6	9	1	26	1	25	18	16	-	-	4	-
47162	9249	2819.0	6	-	35	27	31	1	tr	tr	-	tr	-
47163	9250	2819.4	6	tr	51	2	39	1	1	-	tr	tr	-
47164	9251	2819.7	7	tr	49	5	38	1	tr	-	-	-	-
2. Seam average			8	tr	35	19	31	3	3	tr	tr	1	-
mineral-matter-free			9	tr	38	20	33	-	-	-	-	-	-
3. 47166	9258	2821.8	11	1	51	3	34	tr	tr	-	tr	tr	-
47170	9274	2826.7	2	-	15	50	29	2	2	-	-	tr	-
47171	9275	2827.0	3	-	29	22	46	-	tr	-	-	tr	-
47172	9277	2827.6	tr	-	6	67	23	3	tr	-	-	1	-
47173	9278	2827.9	13	1	34	14	38	-	-	-	-	-	-
47174	9280	2828.5	1	tr	19	10	69	1	tr	-	-	tr	-
47175	9281	2828.8	20	-	5	1	13	32	29	-	tr	tr	- *

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite

Q. - Quartz
Oth.- Other minerals
∅ - includes durite

tr- Trace

* High mineral matter
‡ comprises duroclarite, clarodurite, vitrinertite

TABLE 3.12 (Cont'd)

MICROLITHOTYPE ANALYSES OF COALS FROM BROLGA NO.1 WELL

COOPER BASIN

	Lab.No.	Depth (Feet)	Depth (m)	Vitr-ite	Clar-ite	Inter-med-iates †	Mier-oite ∅	Semi-fus-ite	Shaly Coal	Mineral Matter				
										Cy.	Cb.	Py.	Q.	Oth.
	47176	9283	2829.5	10	-	12	4	38	9	27	-	tr	tr	-
	47177	9284	2829.8	43	7	25	-	25	tr	tr	-	tr	tr	
	47178	9286	2830.4	3	-	22	28	22	15	9	-	-	1	-
4.	Seam average			11	1	18	22	34	7	7	-	tr	tr	-
4.	Clean coal composite excluding 9281'			9	1	20	25	36	4	5	-	tr	tr	-
	mineral-matter-free			10	1	22	27	40	-	-	-	-	-	-
5.	47179	9290.5	2831.7	13	1	62	-	8	15	1	-	tr	tr	-
	mineral-matter-free			16	1	74	-	9	-	-	-	-	-	-
6.	47182	9327	2842.9	16	6	28	1	47	1	1	-	-	-	-
	mineral-matter-free			16	6	29	1	48	-	-	-	-	-	-
7.	47183	9331	2844.1	7	-	24	36	31	1	tr	-	tr	1	-
	mineral-matter-free			7	-	24	37	32	-	-	-	-	-	-
8.	47194	9573	2917.9	20	tr	58	1	14	5	1	-	-	-	-
	mineral-matter-free			22	tr	62	1	15	-	-	-	-	-	-
9.	47198	9598	2925.5	1	-	70	2	20	4	1	-	-	2	-
	47200	9602.5	2926.8	32	-	-	-	1	2	65	tr	tr	-	- *
	seam average			17	-	35	1	10	3	33	tr	tr	1	-
9.	Clean coal composite excluding 9602.5'			1	-	70	2	20	4	1	-	-	2	-
	mineral-matter-free			1	-	75	2	22	-	-	-	-	-	-
10.	47202	9621.75	2932.7	1	-	58	1	7	21	11	-	tr	1	-
	mineral-matter-free			1	-	87	1	11	-	-	-	-	-	-
11.	47204	9630	2935.2	47	2	21	-	21	8	1	-	-	-	-
	mineral-matter-free			52	2	23	-	23	-	-	-	-	-	-

Cy. - Clay
Cb. - Carbonate
Py. - Pyrite

Q. - Quartz
Oth.- Other minerals
∅ - includes durite

tr - Trace
* - High mineral matter

† comprises duroclarite clarodurite vitrinertite

COOPER BASIN : Patchawarra Trough

Mudrangie No.1 Well

MACERAL ANALYSES OF THE ORGANIC MATTER

Nappamerri Formation: Triassic

(Results are given as percentages by volume unless otherwise stated)

	Lab. No. Depth (feet)	Depth (Metres)	Vitrinite	Exinite S	Exinite C	Exinite R	Exinite L	Micrinite	Macrinite	Semi-fusinite	Fusinite	Inerto-detrinite	No of counts	% of sample
1.	78335 8400-8410	2560.3 -2563.4	10	1	2	1	-	2	3	27	2	52	173	22 COAL
2.	78334 8420-8430	2566.4 -2569.5	10 -	1 25	1 -	3 -	- -	3 -	5 -	21 -	1 -	55 75	155 4*	17 COAL tr DOM
3.	78332-33 8500-8520	2590.8 -2596.9	12 -	tr 50	2 50	1 -	1 -	3 -	4 -	25 -	3 -	49 -	434 2*	67 COAL tr DOM
4.	78331 8540-8550	2603.0 -2606.0	10	5	1	2	-	tr	8	20	1	53	184	21 COAL
5.	78330 8610-8620	2624.3 -2627.4	14 34	5 33	1 33	1 -	- -	3 -	3 -	22 -	tr -	51 -	218 3*	24 COAL tr DOM
6.	78329 8670-8680	2642.6 -2645.7	34 -	- -	- -	- -	- 17	- -	- -	33 17	- -	33 66	3* 6*	tr COAL 1 DOM
7.	78328 8810-8820	2685.3 -2688.3	30 -	- 25	7 25	- -	- -	3 -	 -	23 -	- -	37 50	30 4*	3 COAL 1 DOM
8.	78327 8860-8870	2700.5 -2703.6	17 33	16 -	- -	- -	- -	- -	- -	17 17	- -	50 50	6* 6*	0.5 COAL 0.5 DOM

TABLE 4.1

S = sporinite C = cutinite R = resinite L = liptodetrinite

* too few counts to be significant. Results indicate trends only.

Average of DOM in samples = 0.4%

tr = trace

COOPER BASIN : Patchawarra Trough

Mudrangie No.1 Well

MACERAL ANALYSES OF THE ORGANIC MATTER

Toolachee Formation: Permian

(Results are given as percentages by volume unless otherwise stated)

	Lab. No. Depth (feet)	Depth (Metres)	Vitr-inite	Ex-inite S	C	R	L	Micr-inite	Macr-inite	Semi-fusinite	Fusin-ite	Inerto-detrinite	No of counts	% of sample
1.	78326	2718.8	33	-	-	tr	1	1	4	19	3	36	449	79 COAL
	8920-8930	-2721.9	-	-	-	-	-	-	-	-	-	100	1*	tr DOM
2.	78324-25	2721.9	36	3	1	-	-	2	3	16	3	36	414	55 COAL
	8930-8940	-2724.9	8	15	8	-	-	-	-	8	-	61	13	2 DOM
3.	78322-23	2724.9	27	4	1	1	-	1	4	19	4	39	414	73 COAL
	8940-8950	-2728.0	100	-	-	-	-	-	-	-	-	-	1*	tr DOM
4.	78320-21 8950-8960	2728.0 -2731.0	30	2	1	tr	-	1	6	24	4	32	533	96 COAL
5.	78318-19 8960-8970	2731.0 2734.1	29	4	1	-	-	1	6	22	3	34	457	93 COAL
6.	78317 8970-8980	2734.1 -2737.1	33	3	tr	-	-	1	7	20	1	35	452	93 COAL
7.	78316	2746.2	7	9	tr	-	tr	1	2	10	1	70	283	34 COAL
	9010-9020	-2749.3	10	10	-	-	-	-	-	10	-	70	10	1 DOM

TABLE 4.2

tr = trace
S = sporinite
C = cutinite

R = resinite
L = liptodetrinite

* Too few counts to be significant. Results indicate trends only.

Average of DOM in samples = 0.75

TABLE 4.3

COOPER BASIN : PATCHAWARRA TROUGH

Mudrangie No. 1 Well

MACERAL ANALYSES OF THE ORGANIC MATTER

Epsilon and Murteree Formations: Permian

Epsilon Formation

Murteree Formation

Depth (feet)	Depth (m)	Vitr-inite	Exi-nite S	C	R	L	Micr-inite	Macr-inite	Semi-fus-inite	Fus-inite	Iner-todet-rinite	No. of counts	% of sample
78315 9060-9070	2761.5 -2764.5	32	2	-	tr	tr	3	13	21	3	26	517	97 COAL
78314 9070-9080	2764.5 -2767.6	41	2	2	1	-	2	9	12	3	28	531	99 COAL
78313 9180-9190	2798.1 -2801.1	17	17	-	-	-	-	17	16	-	33	6*	1 COAL
		-	5	-	-	-	-	-	19	-	76	37	5 DOM

tr - trace

* Too few counts to be significant
Results indicate trends only

S - sporinite
C - cutinite
R - resinite
L - liptodetrinite

COOPER BASIN : Patchwarra Trough

Mudrangie No.1 Well

MACERAL ANALYSES OF THE ORGANIC MATTER

Patchawarra Formation: Permian

(Results are given as percentages by volume unless otherwise stated)

	Lab. No. Depth (feet)	Depth (Metres)	Vitr-inite	Ex-inite S	Ex-inite C	Ex-inite R	Macr-inite	Micr-inite	Inerto-detr-inite	Semi-fus-inite	Fusin-ite	% of sample	No of count
1.	78312	2813.3	50	6	-	3	-	-	20	18	3	8	34 COAL
	9230-40	-2816.4	33	-	7	-	-	-	53	7	-	4	15 DOM
2.	78311	2825.5	65	2	-	-	2	-	19	10	2	8	43 COAL
	9270-80	-2828.5	28	-	-	-	-	-	44	24	4	5	25 DOM
3.	78310	2837.7	31	-	-	12	-	-	38	13	6	3	16 COAL
	9310-20	-2840.7	12	-	-	2	-	-	61	23	2	9	56 DOM
4.	78309	2856.0	39	3	1	tr	9	1	29	15	3	87	451 COAL
	9370-80	-2859.0	-	-	-	-	-	-	100	-	-	1	*5 DOM
5.	78308	2859.0	36	3	1	-	10	1	24	20	5	96	462 COAL
	9380-90	-2862.1					No DOM						
6.	78307	2862.1	29	3	1	-	4	2	42	13	6	20	164 COAL
	9390-9400	-2865.1	6	-	-	-	-	-	60	34	-	6	53 DOM
7.	78306	2865.1	24	-	1	-	8	-	42	20	5	9	87 COAL
	9400-10	-2868.2	7	3	-	-	-	-	71	18	1	9	85 DOM
8.	78305	2868.2	37	2	tr	tr	9	1	30	18	3	54	304 COAL
	9410-20	-2871.2	20	-	-	-	-	-	80	-	-	2	10 DOM
9.	78304	2871.2	34	2	1	tr	9	2	27	22	3	70	405 COAL
	9420-30	-2874.3					No DOM						
10.	78303	2889.5	32	1	1	-	8	-	35	15	8	6	66 COAL
	9480-90	-2892.6	18	-	2	-	-	-	59	18	3	9	88 DOM
11.	78302	2892.6	16	-	1	-	5	1	57	18	2	20	168 COAL
	9490-9500	-2895.6	4	-	-	-	-	-	86	8	2	6	50 DOM

TABLE 4.4

COOPER BASIN : Patchwarra Trough

Mudrangie No.1 Well

MACERAL ANALYSES OF THE ORGANIC MATTER

Patchawarra Formation: Permian

(Results are given as percentages by volume unless otherwise stated)

	Lab. No. Depth (feet)	Depth (Metres)	Vitr-inite	Ex-inite S	Ex-inite C	Ex-inite R	Macr-inite	Micr-inite	Inerto-detr-inite	Semi-fus-inite	Fusin-ite	% of sample	No. of count
	12. 78301 9500-10	2895.6 -2898.6	36 15	1 -	1 -	- -	5 -	2 -	30 62	17 23	8 -	41 2	243 COAL 13 DOM
	13. 78300 9559-70	2913.6 -2916.9	26 50	2 -	tr -	tr -	12 -	1 -	35 50	21 -	3 -	81 1	429 COAL *6 DOM
	14. 78299 9570-80	2916.9 -2920.0	41	1 No DOM	tr	tr	8	2	29	17	2	96 -	473 COAL -
	15. 78298 9580-90	2920.0 -2923.0	50 16	- -	- -	- -	- -	- -	25 56	- 25	25 3	1 12	*4 COAL 76 DOM
Malabine Seam	(16. 78295 (9600-10	2926.1 -2929.1	16	1 No DOM	-	-	12	1	38	29	3	94 -	495 COAL
	(17. 78294 (9610-20	2929.1 -2932.2	19	1 No DOM	tr	-	10	2	35	30	3	94 -	497 COAL
	(18. 78293 (9620-30	2932.2 -2935.2	21	tr No DOM	-	tr	10	2	39	26	2	96 -	431 COAL
	(19. 78292 (9630-40	2935.2 -2938.3	26 9	tr -	1 -	tr -	8 -	1 -	42 73	20 9	2 9	85 2	469 COAL 11 DOM
	(20. 78291 9640-50	2938.3 -2941.3	27 -	- -	- -	- -	7 -	1 -	48 80	14 20	3 -	81 2	459 COAL 10 DOM
	21. 78290 9650-60	2941.3 -2944.4	19 8	- -	tr -	- -	8 -	tr -	42 67	25 23	6 2	27 6	230 COAL 51 DOM
	22. 78287- 88-89 9670-9700	2947.4 -2956.6	7 -	- -	- -	- -	7 -	- -	54 76	29 24	3 -	12 4	58 COAL 17 DOM

Table 4.4 (Continued)

COOPER BASIN : Patchwarra Trough

Mudrangie No.1 Well

MACERAL ANALYSES OF THE ORGANIC MATTER

Patchawarra Formation: Permian

(Results are given as percentages by volume unless otherwise stated)

Lab. No. Depth (feet)	Depth (Metres)	Vitrinite	Exinite S	Exinite C	Exinite R	Macrinite	Micrinite	Inertodetrinite	Semifusinite	Fusinite	% of sample	No. of count
23. 78286	2959.6	8	-	-	-	8	-	50	17	17	2	12 COAL
9710-20	-2962.7	13	-	-	-	-	-	54	33	-	3	24 DOM
24. 78285	2968.8	40	-	-	-	9	-	32	14	5	23	173 COAL
9740-50	-2971.8	12	-	-	-	-	-	80	8	-	4	25 DOM
25. 78283-84	2977.9	9	-	-	-	-	9	64	18	-	2	11 COAL
9770-90	-2984.0	17	-	-	-	-	-	50	33	-	3	12 DOM
26. 78282	2993.1	43	-	-	-	14	-	29	14	-	3	14 COAL
9820-30	-2996.2	10	-	-	-	-	-	52	28	10	5	29 DOM
27. 78281	2999.2	-	-	-	-	-	-	80	-	20	1	*5 COAL
9840-50	-3002.3	16	-	-	-	-	-	59	25	-	5	32 DOM
28. 78280	3008.4	50	-	-	-	-	-	40	10	-	2	10 COAL
9870-80	-3011.4	23	-	-	5	5	-	62	5	-	4	21 DOM
29. 78279	3017.5	56	-	-	-	8	4	20	5	7	21	177 COAL
9900-10	-3020.6	26	-	-	-	-	-	48	26	-	4	35 DOM
30. 78278	3026.7	24	-	5	5	-	-	52	14	-	4	21 COAL
9930-40	-3029.7	10	-	-	5	-	-	70	15	-	4	20 DOM
31. 78277	3038.9	35	2	2	-	4	-	16	41	-	9	51 COAL
9970-80	-3041.9	11	-	-	-	-	-	47	31	11	3	19 DOM
32. 78276	3051.0	20	-	-	-	-	-	80	-	-	1	*5 COAL
10010-20	-3054.1	20	-	-	-	-	-	40	40	-	3	15 DOM
33. 78275	3057.1	18	3	-	-	10	-	46	23	-	13	61 COAL
10030-40	-3060.2	18	-	-	-	-	-	64	18	-	2	11 DOM
34. 78274	3069.3	25	tr	1	1	9	1	40	20	3	28	237 COAL
10070-80	-3072.4	13	-	-	-	-	-	81	6	-	2	16 DOM

* too few counts for meaningful results

Average DOM in samples = 4.35

TABLE 4.4 (continued)

TABLE 4.5

COOPER BASIN : PATCHAWARRA TROUGH

Mudrangie No.1 Well

MACERAL ANALYSES OF THE ORGANIC MATTER

Tirrawarra and Unnamed Formations: Permian

Formation	Depth (Feet)	Depth (m)	Vitr-inite	Spor-inite	Cut-inite	Resinite/ Lipto-detrinite	Macr-inite	Micr-inite	Inerto-detr-inite	Semi-fus-inite	Fusin-ite	% of sample	No. of counts
Tirra-warra Formation	78273 10100-10	3078.5 -3081.5	40 16	- -	- -	- 4	- -	- -	40 52	20 28	- -	5 7	20 coal 25 DOM
Unnamed Formation	78272 10180-90	3102.9 -3105.9	22	-	-	-	-	-	44	28	6	1 3	*3 coal 15 DOM
	78271 10260-70	3127.2 -3130.3	91	-	-	-	-	-	9	-	-	1 2	*5 coal *6 DOM
	78270 10320-30	3145.5 -3148.6	15					8	54	15	8	6	13 coal
	78269 10350-60	3145.7 -3157.7	33	-	-	-	-	-	56	11	-	1 1	*5 coal *4 DOM
	78268 10380-90	3163.8 -3166.9	25	-	-	-	-	-	75	-	-	1 1	*5 coal *3 DOM
	78267 10420-30	3176.0 -3179.1	- -	- -	- -	- -	- -	- -	100 100	- -	- -	1 tr	*3 coal *1 DOM

* too few counts for meaningful results

Average of DOM = 1.40 in samples

TABLE 4.6

COOPER BASIN : Patchawarra Trough

Mudrangie No.1 Well

Maceral compositions of the coal seams

Toolachee Formation: Permian

Depth (feet)	Depth (m)	Vitr-inite	Spor-inite	Cut-inite	Resinite/ Lipto-detrinite	Macr-inite	Micr-inite	Inerto-detr-inite	Semi-fus-inite	Fusin-ite
Toolachee 1 8920-60	2718.8 to 2731.0	31	3	1	tr	4	1	36	20	4
Toolachee 2 8960-80	2731.0 to 2737.1	31	4	tr	-	7	tr	35	21	2
Toolachee 3 9010-9020	2746.2 to 2749.3	7	9	tr	tr	2	1	70	10	1
			Epsilon Formation: Permian							
Epsilon 1 9060-9080	2761.5 to 2767.6	37	2	1	tr	11	2	27	17	3

TABLE 4.6 (Cont'd)

COOPER BASIN : Patchawarra Trough

Mudrangie No.1 Well

Maceral compositions of the coal seams

Patchawarra Formation: Permian

Depth (feet)	Depth (m)	Vitrinite	Sporinite	Cutinite	Resinite/ Liptodetrinite	Macrinite	Micrinite	Inertodetrinite	Semifusinite	Fusinite
Patchawarra 1 9370-90	2856.0 to 2862.1	38	3	1	tr	10	tr	27	17	4
Patchawarra 2 9410-30	2868.2 to 2874.3	35	2	1	tr	9	1	29	20	3
Patchawarra 3 9500-10	2895.6 to 2898.6	36	1	1	-	5	2	30	17	8
Patchawarra 4 9559-80	2913.6 to 2920.0	26	2	tr	tr	12	1	35	21	3
Patchawarra 5 Malabine seam 9600-50	2926.1 to 2941.3	22	tr	tr	tr	9	1	41	24	3
Patchawarra 6 9900-10	3017.5 to 3020.6	56	-	-	-	8	4	20	5	7
Patchawarra 7 10070-80	3069.3 to 3072.4	25	tr	1	1	9	1	40	20	3

TABLE 4.7

COOPER BASIN : PATCHAWARRA TROUGH

MICROLITHOTYPE ANALYSES OF THE CUTTINGS

Mudrangle No.1 Well

(Results are given as percentages by volume unless otherwise stated)

Formation	Lab. No. Depth (feet)	Depth (m)	Vitrite	Clarite	Intermediates	Microite- + Durite	Semi-fusite + fusite	No. of Counts	Age	
NAPPAMERRI FORMATION	78335 8400-10	2560.3 -2563.4	2	-	11	61	26	204	TRIASSIC	
	78334 8420-30	2566.4 -2569.5	1	1	13	57	28	157		
	78332-33 8500-20	2590.8 -2596.9	4	1	11	57	27	596		
	78331 8540-50	2603.0 -2606.0	3	2	14	53	28	198		
	78330 8610-20	2624.3 -2627.4	9	-	17	45	29	209		
TOOLACHEE FORMATION	78326 8920-30	2718.8 -2721.9	19	tr	26	37	18	476	PERMIAN	
	78324-25 8930-40	2721.9 -2724.9	28	1	20	33	18	363		
	78322-23 8940-50	2724.9 -2728.0	16	-	26	42	16	435		
	78320-21 8950-60	2728.0 -2731.0	18	tr	25	30	27	552		
	78318-19 8960-70	2731.0 -2734.1	10	1	40	26	23	569		
	78317 8970-80	2734.1 -2737.1	18	1	33	29	19	531		
	78316 9010-20	2746.2 -2749.3	4	-	10	82	4	299		
EPSILON FORMATION	78315 9060-70	2761.5 -2764.5	20	-	30	31	19	525	PERMIAN	
	78314 9070-80	2764.5 -2767.6	20	1	46	18	15	510		
PATCHAWARRA FORMATION	78309 9370-80	2856.0 -2859.0	19	2	46	20	13	445	PERMIAN	
	78308 9380-90	2859.0 -2862.1	19	1	42	20	18	486		
	78307 9390-9400	2862.1 -2865.1	8	2	66	14	10	63		Lower Stage 4
	78305 9410-20	2868.2 -2871.2	16	2	41	26	15	334		
	78304 9420-30	2871.2 -2874.3	18	1	34	31	16	383		
	78302 9490-9500	2892.6 -2895.6	10	-	35	46	9	72		Stage 3'

TABLE 4.8

COOPER BASIN : PATCHAWARRA TROUGH

MICROLITHOTYPE ANALYSES OF THE WHOLE SEAMS

Mudrangie No.1 Well

(Results are given as percentages by volume unless otherwise stated)

Depth (feet)	Vitr-ite	Clar-ite	Inter-med iates	Microite- + Durite	Semi-fusite + fusite
NAPPAMERRI 1 8400-10	2	-	11	61	26
NAPPAMERRI 2 7420-30	1	1	13	57	28
NAPPAMERRI 3 8500-20	4	1	11	57	27
NAPPAMERRI 4 8450-50	3	2	14	53	28
NAPPAMERRI 5 8610-20	9	-	17	45	29
TOOLACHEE 1 8920-60	20	tr	24	36	20
TOOLACHEE 2 8960-80	14	1	37	27	21
TOOLACHEE 3 9010-20	4	-	10	82	4
EPSILON 1 9060-80	20	tr	38	25	17
PATCHAWARRA 1 9370-90	19	1	44	20	16
PATCHAWARRA 2 9410-30	17	1	38	29	15
PATCHAWARRA 3 9500-10	24	1	35	23	17
PATCHAWARRA 4 9559-80	20	tr	35	27	18
*PATCHAWARRA 5 9600-50	8	tr	32	36	24
PATCHAWARRA 6 9900-10	46	-	40	2	12
PATCHAWARRA 7 10070-80	15	-	27	32	27

* Probably equivalent to the Malabine seam of Fly Lake No.1 Well

TABLE 4.9

TINDILPIE NO.1 WELL

EROMANGA BASIN : HUTTON FORMATION

Jurassic

MACERAL ANALYSES OF THE ORGANIC MATTER

Lab.No. Depth (feet)	Depth (metres)	Type of organic matter	Vitrinite	Sporinite	Cutinite	Resinite	Alginite	Suberinite	Micrinite	Macrinite	Inertodetrinite	Semifusinite	Fusinite	No.of counts	% of sample
78175	2298.2	coal	66	-	-	1	-	4	1	8	12	8	-	114	14
7540-50	-2301.2	DOM	23	-	-	-	-	-	-	4	65	8	-	26	3
81191	2328.7	coal	51	9	2	5	-	6	3	4	10	9	1	242	26
7640-50	-31.7	DOM	61	3	3	3	-	-	-	-	30	-	-	33	3
78172	2343.9	coal	73	-	-	-	-	9	-	-	-	18	-	11	1
7690-7700	-47.0	DOM	22	15	7	-	4	-	-	-	45	7	-	27	3
78171	2347.0	coal	33	4	2	2	-	3	5	2	29	19	1	487	54
7700-10	-50.0	DOM	9	-	-	-	-	-	-	-	86	5	-	21	2
78170	2350.0	coal	53	4	tr	2	-	4	5	3	20	7	1	591	71
7710-20	-53.1	DOM	8	-	-	-	-	-	-	8	61	23	-	13	1
78169	2353.1	coal	59	3	-	tr	1	2	2	7	21	8	-	192	20
7720-30	-56.1	DOM	48	4	-	4	-	-	-	4	33	7	-	27	3
78168	2356.1	coal	45	5	-	5	-	-	-	-	35	10	-	20	2
7730-40	-59.2	DOM	25	29	4	-	4	-	-	-	29	9	-	24	3
78165	2377.4	coal	76	-	-	8	-	-	8	-	-	8	-	13	2
7800-10	-80.5	DOM	23	5	-	5	-	-	-	5	57	5	-	21	2
78164	2383.5	coal	50	-	-	-	-	13	-	-	25	12	-	8*	2
7820-30	-86.6	DOM	33	-	-	-	-	-	-	-	67	-	-	3*	1
78163	2386.6	coal	50	-	-	-	-	-	-	-	30	20	-	10	2
7830-40	-89.6	DOM	25	-	-	-	-	-	-	-	75	-	-	4*	1

* Too few counts for meaningful results

TABLE 4.10

TINDILPIE NO.1 WELL

PATCHAWARRA TROUGH : NAPPAMERRI FORMATION

Triassic

MACERAL ANALYSES OF THE ORGANIC MATTER

Lab.No. Depth (feet)	Depth (metres)	Type of organic matter	Vitrinite	Sporinite	Cutinite	Resinite	Micrinite	Macrinite	Inertodetrinite	Semi-fusinite	fusinite	No.of counts	% of sample
33185	2395.7	coal	75	-	-	-	-	-	25	-	-	4*	1
7860-70	-98.8	DOM	100	-	-	-	-	-	-	-	-	1*	tr
33184	2529.8	coal	37	2	-	-	-	4	31	26	-	54	6
8300-10	-32.9	DOM	11	-	4	-	-	-	81	4	-	26	3
33183	2548.1	coal	34	4	4	2	2	5	24	25	-	109	12
8360-70	-51.2	DOM	10	-	10	-	-	-	70	10	-	10	1
33182	2557.3	coal	41	-	3	3	-	6	19	28	-	32	5
8390-8400	-2560.3	DOM	-	25	-	-	-	-	75	-	-	4*	tr

* too few counts for meaningful results

TABLE 4.11

TINDILPIE NO.1 WELL

PATCHAWARRA TROUGH : TOOLACHEE FORMATION

Permian

MACERAL ANALYSES OF THE ORGANIC MATTER

Depth (feet)	Lab.No.	Type of organic matter	Vitr-inite	Spor-inite	Cut-inite	Resi-inite	Alg-inite	Micr-inite	Macri-inite	Inerto-detrinite	Semi-fusinite	fus-inite	% of sample	No. of counts
8400-10	78266	coal	43	5	-	1	-	2	7	26	11	5	11	94
		DOM	33	-	-	-	-	-	4	59	4	-	3	27
8410-20	78144	coal	42	-	-	-	-	-	6	26	26	-	3	19
		DOM	-	-	-	-	-	-	-	80	20	-	1	5*
8450-60	78141	coal	49	8	-	-	-	1	3	19	19	1	10	78
		DOM	34	-	-	-	-	-	1	50	-	8	2	12
8470-80	78138	coal	31	6	1	-	-	1	3	43	14	1	46	394
		DOM	27	-	-	-	-	1	2	54	12	-	5	41
8490-8500	78136	coal	36	6	2	-	-	-	-	35	21	-	10	66
		DOM	-	20	-	-	-	-	-	50	30	-	1	10
8500-10	78135	coal	34	3	-	tr	tr	3	3	31	25	1	83	455
		DOM						No DOM						
8510-20	78134	coal	37	8	2	-	-	1	2	26	23	1	22	172
		DOM	7	7	-	-	-	-	-	80	-	6	2	15
8530-40	78132	coal	42	2	-	-	-	-	1	27	25	3	9	67
		DOM	33	-	-	-	-	-	-	67	-	-	tr	3*
8560-70	78129	coal	48	4	1	-	-	2	2	33	10	-	20	153
		DOM	37	4	7	-	-	-	-	37	15	-	3	27
8570-80	78128	coal	36	2	1	-	-	1	1	30	28	1	17	148
		DOM	39	6	-	-	-	-	-	33	22	-	2	18
8590-8600	78126	coal	40	2	tr	1	-	1	1	25	29	1	73	403
		DOM	50	-	-	-	-	-	-	50	-	-	1	4*
8600-10	78125	coal	37	3	1	tr	-	2	3	26	24	4	53	413
		DOM	17	-	-	-	-	-	-	66	17	-	1	12
8610-20	78124	coal	54	6	3	3	-	1	1	20	9	3	20	67
		DOM	30	-	-	-	-	-	-	52	9	3	5	33

* too few counts for meaningful results

TABLE 4.12

TINDILPIE NO.1 WELL

PATCHAWARRA TROUGH

Roseneath Shale

Permian

Maceral analyses of the organic matter

Depth (feet)	Lab.No.	Type of organic matter	Vitrinite	Sporinite	Cutinite	Resinite	Micrinite	Macrinite	Inertodetrinite	Semi-fusinite	Fusinite	No. of counts	% of sample
8620-30	78123	COAL	39	1	-	1	1	2	27	26	3	111	13
		DOM	31	-	-	-	-	-	61	8	-	13	2
8630-40	78122	COAL	44	2	-	-	-	-	27	27	-	45	6
		DOM	30	10	-	-	-	-	60	-	-	10	2
8650-60	78121	COAL	53	3	-	1	1	4	22	13	3	103	15
		DOM	22	5	5	5	-	-	63	-	-	19	3
8660-70	78120	COAL	55	5	1	-	3	-	20	15	1	362	50
		DOM	-	12	-	-	-	-	76	12	-	17	2
8670-80	78119	COAL	54	2	2	-	3	2	12	22	3	193	22
		DOM	4	4	-	-	-	-	88	4	-	26	3
8690-8700	78117	COAL	45	3	2	-	-	1	30	17	2	64	9
		DOM	-	16	-	-	-	-	80	4	-		3
8700-10	78116	COAL	50	3	-	-	-	6	33	8	-	36	10
		DOM	-	-	-	-	-	-	100	-	-	1*	tr

* too few counts for meaningful results

TABLE 4.13

TINDILPIE NO.1 WELL

PATCHAWARRA TROUGH

EPSILON FORMATION

MACERAL ANALYSES OF THE ORGANIC MATTER

Lab.No. Depth (feet)	Depth (m)	Type of organic matter	Vitrinite	Sporinite	Cutinite	Resinite	Alginite	Micrinite	Macrinite	Inertodetrinite	Semifusinite	Fusinite	No. of counts	% of sample
78114	2660.9	COAL	46	4	1	-	-	3	-	25	18	3	149	22
8730-40	-64.0	DOM	9	-	-	-	-	-	-	91	-	-	11	1
78112	2667.0	COAL	37	7	1	-	-	2	-	32	17	4	122	18
8750-60	-70.0	DOM	14	7	-	-	-	-	-	65	14	-	14	2
78111	2670.0	COAL	50	4	tr	-	-	3	-	23	18	2	167	33
8760-70	73.1	DOM	17	8	-	-	-	-	-	59	8	8	12	2
78108	2679.2	COAL	37	5	1	1	-	2	4	27	21	2	467	92
8790-8800	-82.2	DOM	33	-	-	-	-	-	-	67	-	-	3*	tr
78107	2682.2	COAL	33	3	-	-	-	2	4	40	15	3	126	20
8800-10	-75.3	DOM	25	-	4	-	-	-	-	67	-	4	28	5
78106	2685.3	COAL	36	6	1	1	-	tr	3	27	24	2	253	36
8810-20	-88.3	DOM	21	-	-	-	-	-	-	73	6	-	33	4
78105	2688.3	COAL	33	7	1	-	-	2	2	33	21	1	101	15
8820-30	-91.4	DOM	17	5	-	-	-	-	-	78	-	-	18	3
78103	2694.4	COAL	48	9	-	-	-	-	2	16	25	-	67	9
8840-50	-97.5	DOM	23	5	-	-	-	-	-	70	2	-	40	5
78102	2697.5	COAL	37	7	1	1	-	4	2	33	13	2	168	28
8850-60	-2700.5	DOM	28	-	-	-	-	-	-	69	3	-	32	5
78101	2700.5	COAL	50	6	1	-	1	1	4	28	8	1	109	16
8860-70	-03.6	DOM	6	12	-	-	-	-	-	76	6	-	17	2
78100	2703.6	COAL	51	5	tr	tr	-	2	4	19	18	1	339	54
8870-80	-06.6	DOM	50	6	-	-	-	-	-	44	-	-	16	3
78099	2706.6	COAL	49	4	1	tr	-	2	2	22	19	1	444	58
8880-90	-09.7	DOM	57	4	-	-	-	-	-	39	-	-	23	3
78097	2712.7	COAL	42	6	-	-	-	1	2	26	23	-	82	12
8900-10	-15.8	DOM	18	-	-	-	-	-	-	82	-	-	11	2

* Too few counts for meaningful results

TABLE 4.14

TINDILPIE No.1 WELL

PATCHAWARRA TROUGH

Murteree Shale

Maceral analyses of the organic matter

Depth (feet)	Lab.No.	Type of organic matter	Vitrin-ite	Spor-inite	Cutin-ite	Resin-ite	Algin-ite	Micrin-ite	Macrin-ite	Inerto-detrinite	Semi-fusinite	Fusin-ite	No. of counts	% of sample
8910-20	78096	COAL	39	10	-	-	-	2	-	22	22	5	41	6
		DOM	-	14	-	-	5	-	-	76	5	-	21	3
8940-50	78093	COAL	57	14	-	-	-	5	-	14	10	-	21	3
		DOM	7	11	-	-	-	-	-	78	-	4	28	5
8960-70	78091	COAL	59	3	3	2	-	-	-	20	13	-	56	7
		DOM	5	5	-	-	-	-	-	90	-	-	21	2
8980-90	78089	COAL	42	5	-	3	-	3	-	34	10	3	38	4
		DOM	2	19	-	-	2	-	-	77	-	-	43	5
9000-10	78087	COAL	64	5	-	1	-	5	-	12	13	-	85	9
		DOM	6	15	-	-	3	-	-	73	3	-	34	4

COOPER BASIN : Patchawarra Trough

Tindilpie No.1 Well

Patchawarra Formation : Permian

Maceral Analyses of the Organic Matter

Lab. No. Depth (feet)	Type of Organic matter	Vitrinite	Sporinite	Cutinite	Resinite/ Alginite	Micrinite	Macrinite	Inertodetrinite	Semifusinite	Fusinite	No. of counts	% of sample	Seam
78084	COAL	57	3	1	-	4	1	16	16	2	134	17	
9030-9040	DOM	20	20	8	-	-	-	40	8	4	25	3	
78079	COAL	44	1	2	-	1	2	24	22	4	96	17	TIND
9080-9090	DOM	22	12	-	-	-	-	22	22	22	9•	2	1P
78074	COAL	57	7	2	tr/-	3	2	23	6	-	172	22	TIND
9130-9140	DOM	29	10	8	-/3	-	-	45	5	-	38	5	2P
78072	COAL	57	5	3	-	1	-	22	11	1	96	13	TIND
9150-9160	DOM	29	12	3	-	-	-	54	-	2	41	6	3P
78068	COAL	54	7	-	tr/-	1	4	20	12	2	184	25	TIND
9190-9200	DOM	15	4	7	-/7	-	-	54	11	2	46	6	4P
78065	COAL	35	2	1	tr/-	3	12	26	20	1	474	65)	TIND
9220-9230	DOM	21	12	-	-	-	-	49	14	4	43	6)	5P
78064	COAL	51	6	1	-	3	5	16	13	5	140	20)	
9230-9240	DOM	25	4	-	-	-	-	57	11	3	28	4)	
78061	COAL	55	4	3	3/-	4	3	19	7	2	74	10	TIND
9270-9280	DOM	21	11	11	-	-	-	52	-	5	19	3	6P
78059	COAL	53	2	2	tr/-	2	4	26	11	tr	494	83)	
9290-9300	DOM	33	-	-	-	-	-	17	50	-	6•	1)	
78058	COAL	36	1	1	1/-	1	5	38	15	2	446	52)	TIND
9300-9310	DOM	26	2	2	-	-	-	53	15	2	53	6)	7P
78057	COAL	49	1	4	-	2	4	25	12	3	83	9)	
9310-9320	DOM	14	10	2	-	-	-	57	17	-	42	5)	
78050	COAL	55	4	3	-	3	3	22	8	2	130	15	
9380-9390	DOM	21	3	9	-	-	-	55	9	3	33	4	
78046	COAL	50	-	-	-	-	9	21	18	2	44	5	TIND
9420-9430	DOM	13	7	7	-	-	-	57	16	-	30	4	8P
78045	COAL	36	4	4	1/-	2	5	38	9	1	119	14	
9430-9440	DOM	15	-	6	-	-	-	69	8	2	52	6	
78044	COAL	34	7	-	-	-	2	51	4	2	47	5	
9440-9450	DOM	7	3	7	-	-	-	80	3	-	31	4	
78043	COAL	52	2	2	-	3	3	23	12	3	60	8	
9450-9460	DOM	12	6	6	-	-	-	38	38	-	16	2	
78040	COAL	40	4	2	tr/-	1	7	29	12	5	468	81	TIND
9480-9490	DOM				No DOM								9P
78039	COAL	47	-	2	-	-	-	25	22	4	49	6	
9490-9500	DOM	20	2	-	-	-	-	58	13	7	45	5	
78037	COAL	36	2	2	-	6	6	17	29	2	52	8	
9510-9520	DOM	7	-	14	-	-	-	50	22	7	14	2	
78029	COAL	32	2	1	tr/tr	3	12	33	15	2	525	95)	
9600-9610	DOM				No DOM						-	-)	
78028	COAL	24	1	1	tr/tr	1	8	48	14	3	285	57)	TIND
9610-9620	DOM	8	-	-	1/17	-	-	67	8	-	12	2)	10P
78027	COAL	30	1	tr	-/1	1	3	51	10	3	298	35)	
9620-9630	DOM	11	-	-	-/6	-	-	68	13	2	53	6)	
78020	COAL	34	1	tr	tr/-	1	8	29	24	3	265	60)	
9690-9700	DOM	25	-	-	-	-	-	25	50	-	4•	1)	TIND
78019	COAL	38	1	-	-	1	10	29	20	1	148	21)	11P
9700-9710	DOM	23	-	-	-	-	-	46	27	4	26	4)	

Table 4.15

COOPER BASIN : Patchawarra Trough

Tindilpie No.1 Well

Patchawarra Formation : Permian

Maceral Analyses of the Organic Matter

Lab. No. Depth (feet)	Type of Organic matter	Vitrinite	Sporinite	Cutinite	Resinite/ Alginite	Micrinite	Macrinite	Inertodetrinite	Semi-fusinite	Fusinite	No. of counts	% of sample	Seam
78018	COAL	17	1	-	-	3	10	34	29	6	177	18	TIND
9710-9720	DOM	22	-	-	-	-	-	62	11	5	37	4	11P
78014	COAL	40	1	-	-	3	6	26	19	5	129	18	TIND
9750-9760	DOM	31	6	-	-	-	-	50	13	-	16	2	12P
78003	COAL	13	1	-	-	4	6	40	33	3	176	22)	
9860-9870	DOM	18	-	-	-	-	-	56	26	-	34	4)	
78002	COAL	16	2	-	tr/-	3	16	41	19	3	340	62)	
9870-9880	DOM	-	-	-	-	-	-	100	-	-	5*	1)	MALABINE
76001	COAL	38	1	1	-	1	13	24	18	4	160	17)	SEAM
9890-9900	DOM	41	-	-	-	-	-	56	-	3	39	4)	
77999	COAL	35	-	-	1/-	1	8	29	23	3	146	21)	
9900-9910	DOM	32	-	-	-	3	-	58	7	-	31	5)	
77997	COAL	32	1	1	-	3	12	26	20	5	295	34	TIND
9920-9930	DOM	16	-	-	-	-	-	76	8	-	25	3	13P
77994	COAL	24	1	-	-	2	15	40	15	3	212	25	TIND
9950-9960	DOM	10	5	-	-	-	-	70	15	-	20	3	14P
77991	COAL	31	tr	-	-	3	6	50	8	2	383	43	TIND
9980-9990	DOM	8	-	-	-	-	-	78	12	2	59	6	15P
77985	COAL	18	-	-	2/-	2	12	40	18	8	50	7	
10050-10060	DOM	22	-	-	-	-	6	66	6	-	18	3	
77983	COAL	26	2	tr	-	3	15	21	23	10	218	33	TIND
10070-10080	DOM	25	8	-	-	-	-	67	-	-	12	2	16P
77981	COAL	24	1	tr	1/-	2	19	23	26	4	356	50	TIND
10090-10100	DOM	-	-	-	-	-	-	100	-	-	9*	1	17P
77978	COAL	36	1	tr	-	1	12	29	15	5	388	42)	
10120-10130	DOM	19	-	-	-	-	-	44	25	12	16	2)	
77977	COAL	27	1	tr	-	1	15	34	18	4	325	36)	
10130-10140	DOM	32	-	-	-	-	-	68	-	-	25	3)	TIND
77976	COAL	32	-	1	-	3	15	20	20	9	118	18)	18P
10140-10150	DOM	26	-	-	-	-	-	61	9	4	23	3)	
77974	COAL	31	-	-	-	3	18	21	20	7	161	20	
10160-10170	DOM	36	-	-	-	-	-	58	6	-	31	6	
77973	COAL	19	1	-	tr/-	3	17	27	29	4	471	60	TIND
10170-10180	DOM	17	-	-	-	-	-	50	33	-	6*	1	19P
77970	COAL	30	1	tr	-	2	16	28	19	4	219	60	TIND
10200-10210	DOM				No DOM							-	20P
77965	COAL	37	2	-	-	1	13	21	22	4	270	42	TIND
10250-10260	DOM	11	11	-	-	-	-	78	-	-	9*	1	21P
77963	COAL	27	tr	-	1/-	3	11	27	23	8	282	50	TIND
10270-10280	DOM	15	-	-	-	-	-	77	8	-	13	2	22P
77958	COAL	34	1	-	-	2	16	25	17	5	282	39	TIND
10320-10330	DOM	25	-	-	8/-	-	-	50	17	-	12	1	23P
77957	COAL	32	1	1	-	2	13	29	13	9	195	29	
10330-10340	DOM	30	-	-	-	-	-	48	22	-	23	4	
77955	COAL	30	2	-	tr/-	5	11	27	18	7	211	24	
10350-10360	DOM	15	-	-	-	-	-	70	15	-	20	2	
77951	COAL	38	-	-	-	1	9	27	24	1	156	19	
10390-10400	DOM	20	-	-	-	-	-	60	20	-	30	4	

Table 4.15 (continued)

COOPER BASIN : Patchawarra Trough

Tindilpie No.1 Well

Patchawarra Formation : Permian

Maceral Analyses of the Organic Matter

Lab. No. Depth (feet)	Type of Orgnic matter	Vitrinite	Sporinite	Cutinite	Resinite/ Alginite	Micrinite	Macrinite	Inertodetrinite	Semifusinite	Fusinite	No. of counts	% of sample	Seam
77947 10430-10440	COAL	45	1	-	-	3	6	23	15	7	106	14	TIND
	DOM	32	-	-	-	-	-	60	8	-	25	3	24P
77945 10450-10460	COAL	24	-	tr	-	2	13	35	22	4	408	73	TIND
	DOM	33	-	-	-	-	-	50	17	-	6*	1	25P
77943 10470-10480	COAL	26	-	-	-	-	9	24	26	15	78	13	
	DOM	25	-	-	-	-	-	63	12	-	16	3	
77941 10490-10500	COAL	17	3	-	3/-	5	11	31	11	8	36	6	
	DOM	12	-	-	-	-	-	76	12	-	17	3	
77938 10530-10540	COAL	26	3	3	-	3	3	38	21	3	34	6	
	DOM	-	17	-	-	-	-	66	17	-	6*	1	

* Too few counts for meaningful results

Table 4.15 (continued)

TABLE 4.16

TINDILPIE NO. 1 WELL

PATCHAWARRA TROUGH

Tirrawarra Formation

Maceral analyses of the organic matter

	Lab. No. Depth (feet)	Depth (m)	Vitr-inite	Spor-inite	Cut-inite	Resinite/ Liptodet-rinite	Macri-nite	Micri-nite	Inerto-detrinite	Semi-fusinite	Fusin-ite	% DOM in sample	No. of counts
1.	77935	3224.8	40	-	-	-	-	-	33	20	7		15 COAL
	10580-90	-27.8	18	-	-	-	-	-	55	27	-	4	11 DOM
2.	77934	3227.8	46	-	-	-/9	-	-	36	9	-		11 COAL
	10590-10600	-30.9	29	-	-	-	-	-	71	-	-	1	7* DOM
3.	77933	3230.9	34	11	-	-	11	-	22	22	-		9* COAL
	10600-10	-33.9	25	-	-	-	-	-	75	-	-	1	4* DOM
4.	77932	3240.0	33	5	-	-	6	6	17	33	-		18 COAL
	10630-40	-43.1	-	-	-	-	-	-	66	17	17	1	6* DOM
5.	77931	3242.1	35	-	-	-	-	-	39	22	4		23 COAL
	10640-50	-46.1	50	-	-	-	-	-	50	-	-	tr	2* DOM
6.	77930	3246.1	19	-	-	-/5	14	-	24	33	5		21 COAL
	10650-60	-49.2	-	-	-	-	-	-	75	25	-	1	4* DOM
7.	77929	3261.4	36	-	-	-	4	-	24	24	12		25 COAL
	10700-10	-64.4	-	-	11	-	-	-	78	11	-	2	9* DOM
8.	77928	3267.5	38	-	-	6/-	-	-	25	19	12		16 COAL
	10720-30	-70.5	25	-	-	-	-	-	25	25	25	1	4* DOM
9.	77927	3270.5	25	-	-	-	-	-	25	50	-		8* COAL
	10730-40	-73.6	-	-	-	-	-	-	-	-	-	-	- DOM
10.	77926	3273.6	46	-	-	-	-	9	18	27	-		11 COAL
	10740-50	-76.6	25	-	-	-	-	-	25	25	25	1	4* DOM
11.	77925	3282.7	28	-	-	-	3	3	30	33	3		64 COAL
	10770-80	-85.7	-	-	-	-	-	-	100	-	-	tr	1* DOM
12.	77924	3285.7	33	-	-	-	-	-	25	17	25		24 COAL
	10780-90	-88.8	-	-	-	-	-	-	-	50	50	tr	2* DOM
13.	77923	3297.9	40	7	-	-	-	-	20	33	-		15 COAL
	10820-30	-3301.0	-	-	-	-	-	-	50	50	-	tr	2* DOM
14.	77922	3301.0	35	-	-	-	6	6	35	12	6		17 COAL
	10830-40	-04.0	-	-	-	-	-	-	100	-	-	tr	1* DOM
15.	77921	3304.0	27	-	-	-	8	4	38	15	8		26 COAL
	10840-50	-07.1	50	-	-	-	-	-	50	-	-	tr	2* DOM

* Too few counts for meaningful results

Average DOM in samples = 0.80

TABLE 4.17

TINDILPIE NO.1 WELL

PATCHAWARRA TROUGH

Merrimelia Formation

Maceral analyses of the organic matter

	Lab. No. Depth (feet)	Depth (m)	Vitr-inite	Spor-inite	Cut-inite	Resinite/ Liptodet-rinite	Macri-nite	Micri-nite	Inerto-detrinite	Semi-fusinite	Fusin-ite	% DOM in sample	No. of counts
1.	77920	3319.3	28	-	-	-	-	-	37	32	3		72 COAL
	10890-10900	-22.3	-	-	-	-	-	-	-	100	-	tr	1* DOM
2.	77919	3322.3	43	-	-	-	-	-	14	43	-		7* COAL
	10900-10	-25.4	25	-	-	-	-	-	75	-	-	1	4* DOM
3.	77918	3331.5	27	2	-	-	2	-	27	40	2		41 COAL
	10930-40	-34.5	-	-	-	-	-	-	71	29	-	1	7* DOM
4.	77917	3334.5	11	-	-	-	11	11	67	-	-		9* COAL
	10940-50	-37.6	-	-	-	-	-	-	100	-	-	1	4* DOM
5.	77916	3337.6	40	-	-	-	-	-	20	40	-		5* COAL
	10950-60	-40.6	-	-	-	-	-	-	33	67	-	tr	3* DOM
6.	77915	3340.6	72	-	-	-	-	-	14	14	-		7* COAL
	10960-70	-43.7	-	-	-	-	-	-	100	-	-	tr	4* DOM
7.	77914	3349.8	25	-	-	-	25	-	50	-	-		4* COAL
	10990-11000	-52.8	-	-	-	-	-	-	100	-	-	tr	1* DOM
8.	77913	3352.8	14	-	-	-	7	-	29	43	7		14 COAL
	11000-10	-55.8	40	-	-	-	-	-	40	20	-	1	5* DOM
9.	77912	3355.8	12	-	-	-	-	-	50	38	-		8* COAL
	11010-20	-58.9	-	-	-	-	-	-	75	25	-	1	4* DOM
10.	77911	3358.9	50	-	-	6	6	-	25	13	-		16 COAL
	11020-30	-61.9	-	-	-	-	-	-	100	-	-	tr	1* DOM
11.	77910	3361.9	12	6	-	-	-	-	-	82	-		17 COAL
	11030-40	-65.0	-	-	-	-	-	-	50	50	-	tr	2* DOM
12.	77909	3368.0	46	-	-	-	8	-	23	15	8		13 COAL
	11050-60	-71.1	-	-	-	-	-	-	100	-	-	tr	1* DOM
13.	77908	3371.1	30	-	-	-	-	8	46	8	8		13 COAL
	11060-70	-74.1	100	-	-	-	-	-	-	-	-	tr	1* DOM

TABLE 4.17 (Cont'd)

TINDILPIE NO.1 WELL
PATCHAWARRA TROUGH

Merrimelia Formation
Maceral analyses of the organic matter

	Lab. No. Depth (feet)	Depth (m)	Vitrinite	Sporinite	Cutinite	Resinite/ Liptodetrinite	Macrinite	Micrinite	Inertodetrinite	Semifusinite	Fusinite	% DOM in sample	No. of counts
14.	77907	3377.2	29	-	-	-	-	-	43	14	14		7* COAL
	11080-90	-80.2	-	-	-	-	-	-	100	-	-	tr	3* DOM
15.	77906	3380.2	43	-	-	-	-	-	43	14	-		7* COAL
	11090-11100	-83.3	38	-	-	-	-	-	50	12	-	1	8* DOM
16.	77905	3383.3	33	-	-	-	7	7	20	33	-		15 COAL
	11100-10	-86.3	-	-	-	-	-	-	100	-	-	tr	3* DOM
17.	77904	3386.3	28	-	1	1	4	3	28	31	4		144 COAL
	11110-20	-89.4	-	-	25	-	-	-	75	-	-	1	4* DOM
18.	77903	3392.4	38	-	-	3	-	-	28	31	-		29 COAL
	11130-40	-95.5	25	-	-	-	-	-	50	25	-	1	8* DOM
19.	77902	3395.5	19	2	-	2	11	9	35	11	11		56 COAL
	11140-50	-98.5	20	-	-	-	-	-	50	20	10	2	10 DOM
20.	77901	3401.6	21	1	-	-	-	4	26	42	6		84 COAL
	11160-70	-04.6	17	-	-	-	-	-	66	17	-	1	6* DOM

* Too few counts for meaningful results

Average DOM in samples = 0.55

TABLE 4.18

TINDILPIE NO.1 WELL

EROMANGA BASIN

Hutton Formation

Microlithotype Analyses of the Coal

(Results are given as percentages by volume unless otherwise stated)

Lab. No. Depth (feet)	Vitrite	Clarite	Intermediates	Microite+ Durite + Macroite	Semifusite + fusite	No. of counts	% of sample
78175 7450-50	26	22	18	16	18	110	13 TIND IH seam
81191 7640-50	18	33	35	7	7	258	27 TIND 2H seam
78171 7700-10	18	7	34	27	14	346	53
78170 7710-20	29	15	30	20	6	485	71
78169 7720-30	34	15	29	10	12	169	18
Seam Average	26	12	31	21	10		TIND 3H seam

TABLE 4.19

TINDILPIE No.1 WELL

PATCHAWARRA TROUGH

Nappamerri Formation

Microlithotype Analyses of the Coal

(Results are given as percentages by volume unless otherwise stated)

Lab.No. Depth (feet)	Vitrite	Clarite	Intermediates	Microite+ Durite + Macroite	Semifusite+ fusite	No. of counts	% of sample
8360-70	23	3	18	38	18	101	12 TIND 1N seam

TABLE 4.20

TINDILPIE No.1 WELL

PATCHAWARRA TROUGH

Toolachee Formation

Microlithotype Analyses of the Coal

(Results are given as percentages by volume unless otherwise stated)

Lab. No. Depth (feet)	Vitrite	Clarite	Intermediates	Microite+ Durite + Macroite	Semifusite + fusite	No. of Counts	% of sample	
78266 8400-10	29	4	49	3	15	97	11	TIND IT seam
78138 8470-80	13	2	33	39	13	412	48	TIND 2T seam
78135 8500-10	19	tr	40	21	20	488	88	
78134 8510-20	23	1	37	22	17	180	23	
Seam Average	20	tr	40	21	19			TIND 3T seam
78129 8560-70	31	2	32	20	15	157	20	TIND 4T seam
78128 8570-80	22	2	35	12	29	138	16	TIND 5T seam
78126 8590-8600	23	-	38	11	28	523	73	
78125 8600-10	20	1	39	16	24	279	52	
Seam Average	22	tr	39	13	26			TIND 6T seam

TABLE 4.21

TINDILPIE No.1 WELL

PATCHAWARRA TROUGH

Roseneath Shale

Microlithotype Analyses of the Coal

(Results are given as percentages by volume unless otherwise stated)

Lab. No. Depth	Depth (metres)	Vitrite	Clarite	Intermediates	Microite + durite	Semifusite + fusite	No. of counts	% of sample
8620-30	2627.4 -30.4	32	3	32	9	24	117	14
8650-60	2636.5 -39.6	32	5	47	6	10	105	15
8660-70	2639.6 -42.6	34	3	46	7	10	387	51
8670-80	2642.6 -45.7	30	4	42	11	13	178	21

TABLE 4.22

TINDILPIE No.1 WELL

PATCHAWARRA TROUGH

Epsilon Formation

Microlithotype Analyses of the Coals
(Results are given as percentages by volume unless otherwise stated)

Lab. No. Depth (feet)	Depth (metres)	Vitrite	Clarite	Intermediates	Microite+ Durite + Macroite	Semifusite+ Fusite	No. of counts	% of sample
1. 78114 8730-40	2660.9 -64.0	29	3	43	11	14	153	23 TIND 1E
78112 8750-60	2667.0 -70.0	17	3	47	20	13	113	17
78111 8760-70	2670.0 -73.1	28	2	49	12	9	176	34
2. Average		25	2	48	15	10		TIND 2E
78108 8790-8800	2679.2 -82.2	15	2	50	18	15	409	92
78107 8800-10	2682.2 -85.3	14	1	44	24	17	115	18
78106 8810-20	2685.3 -88.3	19	tr	33	29	19	237	33
3. Average		16	2	45	21	16		TIND 3E
78102 8850-60	2697.5 -2700.5	26	4	41	21	8	126	26
78101 8860-70	2700.5 -03.6	24	5	48	21	2	97	15
4. Average		25	4	44	21	6		TIND 4E
78100 8870-80	2703.6 -06.6	27	5	46	11	11	326	54
78099 8880-90	2706.6 -09.7	23	4	48	14	11	420	58
5. Average		25	4	47	13	11		TIND 5E

TABLE 4.23

TINDILPIE No.1 WELL

PATCHAWARRA TROUGH

Murteree Shale

Microlithotype Analyses of the Coal

(Results are given as percentages by volume unless otherwise stated)

Lab.No. Depth (feet)	Depth (metres)	Vitrite	Clarite	Intermediates	Microite+ Durite	Semifusite + fusite	No. of counts
78087 900-10	2743.2 -46.2	29	5	47	9	10	97

TABLE 4.24

TINDILPIE No.1 WELL

PATCHAWARRA TROUGH

Patchawarra Formation

Microlithotype Analyses of the Coals
(Results are given as percentages by volume unless otherwise stated)

Lab. No. Depth (feet)	Depth (metres)	Vitrite	Clarite	Intermediates	Microite + Durite	Semifusite+ fusite	No. of counts	% of sample
78084 1. 9030-40	2752.3 -55.4	41	1	37	8	13	132	17
78079 2. 9080-90	2767.6 -70.6	35	3	28	10	24	101	17 TIND IP
78074 3. 9130-40	2782.8 -85.9	28	13	49	7	3	171	21 TIND 2P
78072 4. 9150-60	2788.9 -92.0	26	12	48	8	6	95	14 TIND 3P
78068 5. 9190-9200	2801.1 -04.2	37	7	38	9	9	185	26 TIND 4P
78065 6. 9220-30	2810.3 -13.3	14	4	41	23	18	375	67))TIND 5P
78064 7. 9230-40	2813.2 -16.4	26	5	45	10	14	131	18)
Average TIND 5P		17	4	42	20	17		
78061 8.9270-80	2825.5 -28.5	40	1	37	11	11	73	10 TIND 6P
78059 9. 9290-9300	2831.6 -34.6	42	5	20	25	8	524	87))TIND 7P
78058 10. 9300-10	2834.6 -37.7	25	2	25	32	16	303	48)

Third cycle

UPPER STAGE 4'

TABLE 4.24 (cont'd)

TINDILPIE NO.1 WELL

PATCHAWARRA TROUGH

Patchawarra Formation

Microlithotype Analyses of the Coals
(Results are given as percentages by volume unless otherwise stated)

Lab. No. Depth (feet)	Depth (metres)	Vitrite	Clarite	Intermediates	Microite + Durite	Semifusite+ fusite	No. of counts	% of sample
78057 11. 9310-20	2837.7 -40.7	39	4	27	18	12	89	10 TIND 7P
Average TIND 7P		36	4	22	27	11		
78050 12. 9380-90	2859.0 -62.1	29	7	41	13	10	129	15
78045 13. 9430-40	2874.3 -77.3	31	7	13	44	5	134	16 TIND 8P
78040 14. 9480-90	2889.5 -92.6	24	3	33	25	15	441	78 TIND 9P
78029 15. 9600-10	2926.1 -29.1	16	tr	35	28	21	555	96)
78028 16. 9610-20	2929.1 -32.2	8	1	20	58	13	459	66) TIND 10P
78027 17. 9620-30	2932.2 -34.2	13	3	26	51	7	343	38)
Average TIND 10P		13	1	28	42	16		
78020 18. 9690-9700	2953.5 -56.6	23	2	15	38	22	501	60)
78019 19.9700-10	2956.6 -59.6	31	1	15	34	19	159	22) TIND 11P
78018 20. 9710-20	2959.6 -62.7	10	1	13	44	32	158	17)

Third cycle

STAGE 3'

TABLE 4.24 (cont'd)

TINDILPIE No.1 WELL

PATCHAWARRA TROUGH

Patchawarra Formation

Microlithotype Analyses of the Coals
(Results are given in percentages by volume unless otherwise stated)

Lab. No. Depth (feet)	Depth (metres)	Vitrite	Clarite	Intermediates	Microite + Durite	Semifusite+ fusite	No. of counts	% of sample
Average TIND 11P		22	2	15	38	23		
78014 21. 9750-60	2971.8 -74.8	24	1	27	27	21	146	20 TIND 12P
78003 22. 9860-70	3005.3 -08.4	3	1	17	41	38	193	25) MALABINE SEAM
78002 23. 9870-80	3008.4 -11.4	6	tr	26	47	21	329	61)
78001 24. 9880-90	3011.4 -14.5	8	tr	32	34	26	465	76)
78000 25. 9890-9900	3014.5 -17.5	33	-	26	20	21	159	18)
77999 26. 9900-10	3017.5 -20.6	23	1	25	27	24	152	22)
Average Malabine Seam		11	tr	27	37	25		
77997 27. 9920-30	3023.6 -26.7	21	1	25	31	22	344	38 TIND 13P
77994 28. 9950-60	3032.8 -35.8	13	tr	34	39	14	227	26 TIND 14P
77991 29. 9980-90	3041.9 -45.0	12	-	48	35	5	387	41 TIND 15P
77983 30. 20070-80	3069.3 -72.4	15	1	28	34	22	228	33 TIND 16P
77981 31. 10090-10100	3075.4 -78.5	11	1	27	31	30	361	50 TIND 17P

Second cycle

TABLE 4.24 (cont'd)

TINDILPIE NO.1 WELL

PATCHAWARRA TROUGH

Patchawarra Formation

Microlithotype Analyses of the Coals
(Results are given in percentages by volume unless otherwise stated)

Lab. No. Depth (feet)	Depth (metres)	Vitrite	Clarite	Intermediates	Microite + Durite	Semifusite+ fusite	No. of counts	% of sample
77978 32.10120-30	3084.6 -87.6	28	tr	31	25	16	420	44
77977 33.10120-40	3087.6 -90.7	17	1	27	40	15	337	38 TIND 18P
77976 34.10140-50	3090.7 -93.7	15	2	36	22	25	114	16
Average TIND 18P		22	1	30	30	17		
77974 35.10160-70	3096.8 -99.8	15	tr	41	29	15	175	22
77973 36.10170-80	3099.8 -3102.9	6	-	30	38	26	529	63
Average TIND 19P		8	tr	33	36	23		
77970 37.10200-10	3109.0 -12.0	11	1	33	38	17	161	53 TIND 20P
77965 38.10250-60	3124.2 -27.2	18	1	35	25	21	277	42 TIND 21P
77963 39.10270-80	3130.3 -33.3	16	1	28	30	25	294	50 TIND 22P
77958 40.10320-30	3145.5 -48.6	14	1	36	25	24	278	39) TIND 23P
41.10330-40	3148.6 -51.6	22	-	39	20	19	191	28) TIND 23P
Average TIND 23P		17	1	37	23	22		

First cycle

STAGE 3'

TABLE 4.24 (cont'd)

TINDILPIE No.1 WELL

PATCHAWARRA TROUGH

Patchawarra Formation

Microlithotype Analyses of the Coals
(Results are given in percentages by volume unless otherwise stated)

FIRST CYCLE

Lab. No. Depth (feet)	Depth (metres)	Vitrite	Clarite	Intermediates	Microite + Durite	Semifusite+ fusite	No. of counts	% of sample
77955 42.10350-60	3154.7 -57.7	11	-	38	24	27	191	23
77951 43.10390-10400	3166.9 -69.9	23	1	36	16	24	183	21
77947 44.10420-40	3179.1 -82.1	29	1	39	12	19	111	14 TIND 24P
77945 45.10450-60	3185.2 -88.2	11	-	32	39	18	431	75 TIND 25P

STAGE 3'

PEDIRKA BASIN

LOWER PERMIAN

TABLE 6.1. MACERAL ANALYSES OF THE COALS

Formation	Depth: Feet	Depth: Metres	Vitrinite	Exinite	Inertodetrinite + Micrinite + Macrinite	Semi-Fusinite	Fusinite	Minerals	
					MOKARI NO.1 WELL				
Purni Formation, Upper	6050	1844.1	11	8	51	25	2	3	Cuttings
		mmf	11	8	53	26	2		
Purni Formation, Upper	6060	1847.1	15	7	33	35	1	9	Cuttings
		mmf	17	8	36	38	1		
Purni Formation, Upper	6220	1895.9	45	15	16	14	1	9	Cuttings
		mmf	49	17	18	15	1		
Purni Formation, Upper	6320	1926.3	37	16	24	14	1	8	Cuttings
		mmf	40	18	26	15	1		
Purni Formation, Upper	6330	1929.4	60	9	14	12	1	4	Cuttings
		mmf	63	9	15	12	1		
Purni Formation, Lower	6760	2060.4	57	6	12	18	2	5	Cuttings
		mmf	60	6	13	19	2		
					PURNI NO.1 WELL				
Purni Formation, Upper	4665-70	1421.9-23.4	64	11	4	13	1	7	Cuttings
		mmf	69	12	4	14	1		
Purni Formation, Upper	4720-25	1438.7-40.2	18	8	31	32	2	9	Cuttings
		mmf	20	9	34	35	2		
Purni Formation, Upper	4725-30	1440.2-41.7	56	11	7	17	2	7	Cuttings
		mmf	60	12	8	18	2		
Purni Formation, Middle	4850-55	1478.3-79.8	55	16	14	8	1	6	Cuttings
		mmf	59	17	15	8	1		
Purni Formation, Middle	5085.5 (core)	1550.1	45	21	6	10	13	5	
		mmf	47	22	6	11	14		

mmf = mineral matter free

TABLE 6.2 Characteristics of dispersed organic matter in sediments from Mokari No.1 and Purni No.1 Wells, Pedirka Basin

Lab. No.	Depth (ft.)	Depth (m)	vol DOM rock type	Form of exinite DOM (F.L.)	Relative quantities of exinite DOM	Ratio opaque: transparent
Mokari No.1						
48699	6076	1852.0	50 black shale	microspores algae cuticle	plentiful sparse sparse	O: 95 T: 5
48698	6087.8	1855.6	5 sandy siltstone	microspores cuticle	rare rare	O: 95 T: 5
48697	6087.9	1855.6	10 carbonaceous siltstone	microspores cuticle	rare rare	O: 60 T: 40
48696	6555	1998.0	10 black silty shale	microspores algae cuticle	plentiful sparse sparse	O: 50 T: 50
Purni No.1						
48702	5092	1552.0	10 carbonaceous siltstone/ sandstone contact	microspores algae cuticle	plentiful sparse sparse	O: 99 T: 1
48701	5255	1601.7	40 black carbonaceous shale	microspores cuticle algae	plentiful plentiful rare	O: 5 T: 95
48700	5280-5281	1609.3-1609.6	2 pale grey laminated siltstone	microspores algae, resin cuticle	sparse rare rare	O: 99 T: 1

DOM - dispersed organic matter

F.L. - fluorescent light

Plentiful: 50% and more of the exinite
sparse: 10% of the exinite
rare: less than 5% of the exinite

TABLE 6.3

Pedirka Basin: Macumba No.1 Well

Lower Permian

Maceral analyses of the organic matter

Purni Formation

Depth (feet)	Depth (metres)	Lab.No.		Vitr-inite	Spor-inite	Cut-inite	Resinite/ Lipto-detrinite	Macr-inite	Micr-inite	Inerto-detr-inite	Semi-fus-inite	Fusi-inite	No.of counts
1.8030-40	2447.5-50.6	61796	Coal	40	-	20	-	-	-	20	20	-	5*
			DOM	11	11	-	-	-	-	67	11	-	9*
2.8060-70	2456.7-59.7	61799	Coal	52	6	6	2	-	3	19	7	5	103
			DOM	30	4	8	-	-	-	50	8	-	26
3.8070-80	2459.7-62.8	61800	Coal	36	9	9	-	5	-	14	18	9	22
			DOM	38	-	-	-	-	-	38	19	5	21
4.8080-90	2462.8-65.8	61801	Coal	49	3	-	3	-	-	24	9	12	33
			DOM	28	8	8	-	-	-	28	28	-	14
5.8090-8100	2465.8-68.9	61802	Coal	83	-	-	-	-	-	-	-	17	6*
			DOM	No DOM counted									
6.8100-10	2468.9-71.9	61803	Coal	38	4	5	1	4	1	28	16	3	193
			DOM	28	17	3	-	-	-	36	11	5	36
7.8110-20	2471.9-75.0	61804	Coal	34	3	3	-	3	3	36	15	3	33
			DOM	21	-	-	-	-	-	54	25	-	24
8.8120-30	2475.0 78.0	61805	Coal	27	5	14	-	2	2	22	26	2	58
			DOM	27	13	-	-	-	-	40	20	-	15
9.8130-40	2478.0-81.1	61806	Coal	61	3	8	-	3	3	5	17	-	36
			DOM	20	-	10	-	-	-	40	30	-	10
10.8140-50	2481.1-84.1	61807	Coal	27	5	5	-	-	-	47	16	-	19
			DOM	25	8	25	-	-	-	34	8	-	12
11.8150-60	2484.1-87.2	61808	Coal	59	4	7	-	-	4	15	11	-	27
			DOM	14	-	43	-	-	-	14	29	-	7*
12.8160-70	2487.2-90.2	61809	Coal	53	9	3	-	3	3	14	9	6	34
			DOM	20	-	-	-	-	50	30	-	-	10

TABLE 6.3 (continued)

Pedirka Basin: Macumba No.1 Well

Lower Permian

Maceral analyses of the organic matter

Purni Formation

Depth (feet)	Depth (metres)	Lab.No.		Vitr-inite	Spor-inite	Cut-inite	Resinite/ Lipto-detrinite	Macr-inite	Micr-inite	Inerto-detr-inite	Semi-fus-inite	Fusi-inite	No. of counts
13.8170-80	2490.2-93.3	61810	Coal	33	3	8	2	5	-	36	10	3	39
			DOM	15	8	8	-	-	-	31	38	-	13
14.8180-90	2493.3-96.3	61311	Coal	29	12	5	-	-	2	28	19	5	42
			DOM	24	9	-	-	-	-	43	19	5	21
15.8190-8200	2496.3-99.4	61812	Coal	43	11	7	2	-	-	21	16	-	44
			DOM	12	12	12	-	-	-	47	17	-	17
16.8200-10	2499.4-2502.4	61813	Coal	45	-	11	11	-	-	11	22	-	9*
			DOM	7	14	8	-	-	-	43	29	-	14
17.8280-90	2523.7-26.8	61821	Coal	25	-	25	-	-	-	50	-	-	4*
			DOM	33	-	11	-	-	-	33	23	-	9*
18.8290-8300	2526.8-29.8	61822	Coal	44	6	-	-	6	-	6	27	11	18
			DOM	33	11	-	-	-	-	56	-	-	9*
19.20.21 8310-40	2532.9-42.0	61824-26			No organic matter apparent in these samples								
22.8340-50	2542.0-45.1	61827	Coal	67	-	-	-	-	-	33	-	-	3*
			DOM	-	-	-	-	-	-	100	-	-	1*

* Too few counts for meaningful results

TABLE 6.4

Pedirka Basin: Macumba No.1

Middle to Upper Triassic

Maceral analyses of the organic matter

Peera Peera Formation

Depth (feet)	Depth (metres)	Lab.No		Vitr-inite	Spor-inite	Cuti-nite	Resinite+ Liptodetr-inite	Macri-nite	Micr-inite	Inerto-detr-inite	Semi-fus-inite	Fusi-nite	No. of counts
1.7520-30	2292.1 -95.1	61747	Coal	43	-	-	14	-	7	29	7	-	14
			DOM	9	9	-	-	-	-	52	26	4	23
2.7530-40	2295.1 -98.2	61748	Coal	42	-	8	8	-	-	34	8	-	12
			DOM	20	10	-	-	-	-	70	-	-	10
3.7540-50	2298.2-2301.2	61749	Coal	10	-	30	30	-	-	10	20	-	10
			DOM	32	10	5	-	-	-	32	21	-	19
4.7570-80	2307.3 -10.4	61752	Coal	33	-	33	-	-	-	34	-	-	3*
			DOM	26	-	7	7	-	-	34	26	-	15
5.7580-90	2310.4 -13.4	61753	Coal	33	-	33	-	-	-	-	-	34	3*
			DOM	-	-	40	-	-	-	40	20	-	5*
6.7630-40	2325.6 -28.7	61758	Coal	56	-	11	-	-	-	33	-	-	9*
			DOM	6	-	31	-	-	-	44	19	-	16*
7.7640-50	2328.7 -31.7	61759	Coal	20	-	-	-	-	-	-	40	40	5*
			DOM	23	-	20	3	-	-	44	7	3	30
8.7650-60	2331.7 -34.8	61760	Coal	33	-	-	-	-	-	67	-	-	3*
			DOM	25	-	-	-	-	-	-	75	-	4*
9.7660-70	2334.8 -37.8	61761	Coal	40	20	20	-	-	-	-	20	-	5*
			DOM	18	3	15	-	-	-	46	15	3	39
10.7670-80	2337.8 -40.9	61762	Coal					No coal					
			DOM	10	-	16	1	-	-	57	13	3	59
11.7680-90	2340.9 -43.9	61763	Coal					No coal					
			DOM	24	4	9	2	-	-	52	9	-	46

TABLE 6.4 (continued)

Pedirka Basin: Macumba No.1

Middle to Upper Triassic

Maceral analyses of the organic matter

Peera Peera Formation

Depth (feet)	Depth (mtrs)	Lab.No		Vitr-inite	Spori-nite	Cuti-nite	Resinite+ Liptodetr-inite	Macri-nite	Micr-inite	Inerto-detr-inite	Semi-fus-inite	Fusi-nite	No. of counts
12.7690-7700	2343.9-47.0	61764	Coal	No coal									
			DOM	27	3	18	–	–	–	49	3	–	33
13.7700-10	2347.0-50.0	61765	Coal	No coal									
			DOM	44	–	31	–	–	–	19	6	–	16
14.7720-30	2353.1-56.1	61767	Coal	–	–	14	–	–	–	29	57	–	7*
			DOM	26	7	7	–	–	7	40	13	–	15
15.7740-50	2359.2-62.2	61769	Coal	66	–	–	–	17	–	–	17	–	6*
			DOM	24	–	23	6	–	–	35	12	–	17
16.7780-90	2371.3-74.4	61771	Coal	50	–	–	–	–	–	50	–	–	2*
			DOM	–	–	20	–	–	–	60	20	–	5*
17.7790-7800	2374.4-77.4	61772	Coal	40	–	40	–	–	–	20	–	–	5*
			DOM	34	–	25	8	–	–	25	8	–	12
18.7800-10	2377.4-80.5	61773	Coal	100	–	–	–	–	–	–	–	–	5*
			DOM	33	–	–	–	–	–	22	45	–	9*
19.7810-20	2380.5-83.5	61774	Coal	18	–	–	–	–	–	70	12	–	17
			DOM	10	10	40	–	–	–	40	–	–	10
20.7820-30	2383.5-86.6	61775	Coal	39	–	15	8	15	–	23	–	–	13
			DOM	–	–	17	–	–	–	83	–	–	6*
21.7830-40	2386.6-89.6	61776	Coal	–	–	–	–	–	–	–	100	–	1*
			DOM	13	–	29	–	–	–	29	29	–	7*
22.7840-50	2389.6-92.7	61777	Coal	100	–	–	–	–	–	–	–	–	2*
			DOM	40	–	20	–	–	–	40	–	–	5*
23.7850-60	2392.7-95.7	61778	Coal	19	–	–	–	–	–	52	29	–	21
			DOM	–	–	–	–	–	–	100	–	–	3*

TABLE 6.4 (continued)

Pedirka Basin: Macumba No.1

Middle to Upper Triassic

Maceral analyses of the organic matter

Peera Peera Formation

Depth (feet)	Depth (mtrs)	Lab.No		Vitr-inite	Spori-nite	Cuti-nite	Resinite+ Liptodetr-inite	Macri-nite	Micr-inite	Inerto-detr-inite	Semi-fus-inite	Fusi-nite	No. of counts
24.7860-70	2395.7 -98.8	61779	Coal	54	-	8	8	-	-	23	7	-	13
			DOM	11	-	-	-	-	-	56	33	-	9*
25.7870-80	2398.8 2401.8	61780	Coal	-	-	-	-	-	-	33	17	50	6*
			DOM	-	-	-	-	-	-	36	67	-	3*
26.7880-90	2401.8 -04.9	61781	Coal	77	-	-	-	6	6	11	-	-	18
			DOM	13	-	29	-	-	-	29	29	-	7*
27.7890-7990	2404.9 -07.9	61782	Coal	12	3	6	6	3	-	55	15	-	33
			DOM	-	-	-	-	-	-	67	33	-	6*
28.7900-10	2407.9 -11.0	61783	Coal	30	-	10	-	-	-	40	20	-	10
			DOM	-	50	50	-	-	-	-	-	-	2*
29.7910-20	2411.0 -14.0	61784	Coal	27	-	-	-	-	-	18	37	18	11
			DOM	-	50	-	-	-	-	17	33	-	6*
30.7920-30	2414.0 -17.1	61785	Coal	35	10	-	-	-	-	10	45	-	20
			DOM	10	-	-	-	-	-	45	45	-	9*
31.7970-80	2429.3 -32.3	61790	Coal	75	-	-	-	-	25	-	-	-	4*
			DOM	25	6	6	-	-	-	44	19	-	16
32.7990-8000	2535.4 -38.4	61792	Coal	34	-	22	11	-	-	22	11	-	9*
			DOM	33	-	-	-	-	-	50	17	-	6*
33.8000-10	2438.4 -41.4	61793	Coal	66	-	17	-	-	-	-	17	-	6*
			DOM	6	-	6	6	-	-	63	19	-	16

* too few counts for meaningful results

TABLE 6.5

Pedirka Basin: Poolowanna No.1 Well

Triassic

Maceral analyses of the dispersed organic matter

Peera Peera and Walkandi Formations
(results are given as percentages by volume unless otherwise stated)

Depth (feet)	Depth (metres)	Lab.No.	Vitrinite	Resinous Vitrinite	Sporinite	Cutinite	Resinite	Micrinite	Inertodetrnite	Semifusinite	Fusinite	No. of counts
1.8500-8510	2590.8-2593.8	60014	30	5	1	10	2	1	30	19	2	167
2.8510-8520	2593.8-2596.9	60015	15	-	1	8	-	-	54	22	-	97
3.8520	2596.9	59991	9	-	3	3	5	-	66	13	1	98
4.8520-8530	2596.9-2599.9	60016	18	-	-	18	3	-	48	11	2	73
5.8530-8540	2599.9-2693.0	60017	9	-	-	11	1	-	52	24	3	104
6.8535	2601.5	59990	15	-	6	5	4	-	54	14	2	124
7.8540-8550	2603.0-2606.0	60018	28	-	-	18	-	-	28	24	2	76
8.8550-8560	2606.0-2609.1	60019	12	-	-	13	-	-	43	31	1	107
9.8560-8570	2609.1-2612.1	60020	26	2	-	9	2	-	41	20	-	130
10.8570-8580	2612.1 2615.2	60021	14	-	2	13	2	3	43	21	2	106
11.8580-8590	2615.2-2618.2	60022	36	2	2	14	-	-	12	30	4	66
12.8660-8670	2639.6-2642.6	60030	59	-	-	3	2	-	11	23	2	64

Peera Peera Formation

TABLE 6.5 (continued)

Pedirka Basin: Poolowanna No.1 Well

Triassic

Maceral analyses of the dispersed organic matter

Peera Peera and Walkandi Formations

Depth (feet)	Depth (metres)	Lab.No.	Vitr-inite	Resi-nous Vitr-inite	Spor-inite	Cut-inite	Resi-nite	Micr-inite	Inerto-detr-inite	Semi-fus-inite	Fusi-nite	No. of counts	
13.8700-8710	2651.8-2654.8	60034	51	-	-	10	-	-	17	17	5	63	Peera Peera Formation
14.8710-8720	2654.8-2657.9	60035	11	-	-	15	-	-	63	11	-	85	
15.8780-8790	2676.1-2679.2	60042	44	3	1	2	2	3	24	19	2	Partly Coal 270	
16.8980-8990	2737.1-2740.2	60068	30	1	1	6	2	6	45	9	tr	454 Coal	
17.8990-9000	2740.1-2743.2	60069	23	-	1	5	3	2	47	19	-	89	
18.9060-9070	2761.5-2764.5	60076	33	3	-	8	2	tr	26	26	2	172	Walkandi Formation
19.9181-9188	2798.4-2800.5	60088	67	-	1	1	4	-	17	8	2	Coal 160	
20.9450-9460	2880.4-2883.4	60121	38	7	2	4	4	2	36	7	-	45	

tr = trace

TABLE 6.6

Microlithotype analyses of Pedirka Basin Coals

Purni Formation

Depth (feet)	Depth (metres)	Vitr-ite	Clar-ite	Inter-mediates	Microite +Durite	Semi fusite + Fusite	Lab. No.
				MOKARI No.1 WELL			
6050	1844.0	2	tr	19	52	27	47318
6060	1847.1	7	tr	27	40	26	47319
6220	1895.9	29	5	38	15	13	47320
6320	1926.3	12	4	52	23	9	47321
6330	1929.4	37	14	36	5	8	47322
6760	2060.4	42	6	32	6	14	47323
				PURNI NO.1 WELL			
4665-70	1421.9-23.4	51	8	29	3	9	47314
4720-25	1438.7-40.2	12	-	22	32	34	47315
4725-30	1440.2-41.7	41	12	22	9	16	47316
4850-55	1478.3-79.8	27	6	59	2	6	47317
5085.5	1550	12	42	31	-	15	47312

TABLE 6.7

Pedirka Basin: Macumba No.1 well

Lower Permian

Purni Formation

Microlithotype analyses of the cuttings
(Results are given as percentages by volume unless otherwise stated)

Lab.No. Depth (feet)	Depth (metres)	Vitr-ite	Clar-ite	Inter-med-iates	Microite + Durite	Semi-fusite + Fusite	No. of counts
61803 8100-10	2468.9 - 71.9	20	1	46	19	14	187

TABLE 6.8

Pedirka Basin: Poolowanna No.1 well

Peera Peera and Walkandi Formations

Microlithotype analyses of the Triassic coals

(Results are given as percentages by volume unless otherwise stated)

Lab.No. Depth (feet)	Depth (metres)	Vitr-ite	Clar-ite	Inter-med-iates	Microite + Durite	Semi-fusite + Fusite	No. of counts
60042 8780-8790	2676.1 -2679.2	37	7	19	16	21	217
60068 8980-8990	2737.1 -2740.2	17	5	17	53	8	429
6088 9181-9188	2798.4 -1800.5	70	2	16	6	6	128

TABLE 7.1

MACUMBA NO.1 WELL
Maceral Analyses of the Coal and Dispersed Organic Matter
from the Lower to Middle Jurassic Sediments
Poolowanna Formation
(Results are given as percentages by volume unless otherwise stated)

Lab.No. depth (feet)	Depth (metres)		Vitrinite	Resinous Vitrinite	Sporinite	Cutinite	Resinite	Micr-inite	Macr-inite	Semi-fusinite	Fusi-nite	Inerto-detrinite	No. of counts	% Org-anic matter
61713 7180-	2188.5	COAL	56	6	1	tr	4	2	-	17	tr	14	517	95
7190	-2191.5	DOM	24	-	12	-	-	-	-	24	-	40	25	5
61714 7190-	2191.5	COAL	45	10	4	1	3	-	1	15	1	20	554	100
7200	-2194.6						NO DOM							
61715 7200-	2194.6	COAL	73	3	2	tr	2	-	tr	10	-	10	611	96
7210	-2197.6	DOM	8	-	4	-	-	-	-	16	-	72	25	4
61716 7210-	2197.6	COAL	42	1	6	-	3	tr	-	28	2	18	408	94
7220	-2200,7	DOM	29	-	13	4	-	-	-	21	-	33	24	6
61717 7220-	2200.7	COAL	58	4	2	3	3	-	tr	18	-	12	305	90
7230	-2203.7	DOM	53	-	22	-	6	-	-	3	-	16	32	10
61718 7230-	2203.7	COAL	68	10	8	1	tr	-	-	3	2	8	210	86
7240	-2206.8	DOM	31	6	29	-	-	-	-	26	-	8	35	14
61719 7240-	2206.8	COAL	39	4	6	1	6	2	2	29	-	11	171	72
7250	-2209.8	DOM	20	3	27	11	3	-	-	7	-	29	66	28
61720 7250-	2209.8	COAL	60	7	3	2	2	2	3	10	1	10	434	99
7260	-2212.9	DOM	-	-	50	16	16	-	-	18	-	-	6	1

TABLE 7.1 cont'd

MACUMBA NO.1 WELL
Maceral Analyses of the Coal and Dispersed Organic Matter
From the Lower to Middle Jurassic Sediments
Poolowanna Formation
(Results are given as percentages by volume unless otherwise stated)

Lab.No. Depth (feet)	Depth (metres)		Vitr-inite	Resinous Vitrinite	Sporinite	Cutinite	Resinite	Micr-inite	Macr-inite	Semi-fusinite	Fusi-nite	Inerto-detrinite	No. of counts	% Org-anic Matter
61721	2212.9	COAL	57	10	2	1	3	1	-	11	2	13	501	96
7260-	-2215.9	DOM	47	-	12	-	-	-	-	-	6	35	17	4
7270														
61722	2215.9	COAL	64	8	3	tr	3	1	-	12	tr	9	507	95
7270-	-2218.9	DOM	26	-	9	4	4	-	-	18	-	39	23	5
7280														
61723	2218.9	COAL	55	10	3	2	3	2	1	12	2	10	491	95
7280-	-2222.0	DOM	23	-	23	11	-	-	-	8	-	35	26	5
7290														
61724	2222.0	COAL	60	7	3	1	1	1	1	14	1	11	258	81
7290-	-2225.0	DOM	50	-	10	5	-	-	-	7	3	25	60	19
7300														
61725	2225.0	COAL	48	13	5	1	4	4	1	9	2	13	228	81
7300-	-2228.1	DOM	29	-	11	4	10	-	-	4	8	34	52	19
7310														
61726	2228.1	COAL	66	12	3	2	5	2	2	4	tr	4	558	94
7310-	-2231.2	DOM	42	10	3	-	8*	-	-	5	3	29	38	6
7320														
61727	2231.2	COAL	68	19	2	2	1	tr	2	2	1	3	383	85
7320-	-2234.2	DOM	34	3	8	2	9	-	-	3	5	36	64	14
7330														
61728	2234.2	COAL	47	19	2	4	10	2	1	7	-	8	311	86
7330-	-2237.2	DOM	31	2	14	2	10	-	-	4	2	35	51	14
7340														

TABLE 7.1 cont'd

MACUMBA NO.1 WELL
Maceral Analyses of the Coal and Dispersed Organic Matter
From the Lower to Middle Jurassic Sediments
Poolowanna Formation
(Results are given as percentages by volume unless otherwise stated)

Lab.No. Depth (feet)	Depth (metres)		Vitrinite	Resinous Vitrinite	Sporinite	Cutinite	Resinite	Micrinite	Macrinite	Semi-fusinite	Fusinite	Inertodetrinite	No. of counts	% Organic Matter
61729 7340-7350	2237.2 -2240.3	COAL	42	21	4	3	6	1	2	10	1	10	158	71
		DOM	33	-	14	6	9	-	-	9	-	29	66	29
61730 7350-7360	2240.3 -2243.3	COAL	34	11	8	4	15	4	-	5	2	17	239	82
		DOM	22	2	23	14	2	-	-	2	2	33	51	18
61731 7360-7370	2243.3 -2246.4	COAL	51	14	1	7	7	2	-	10	-	8	122	70
		DOM	29	4	15	9	4	-	-	6	-	33	52	30
61732 7370-7380	2246.4 -2249.4	COAL	25	8	8	-	25	-	-	25	-	9	12	60WS
		DOM	25	-	38	-	-	-	-	-	-	37	8	40
61733 7380-7390	2249.4 -2252.5	COAL	34	4	1	2	6	1	5	24	1	22	138	77
		DOM	26	5	7	5	-	-	-	24	-	33	42	23
61734 7390-7400	2252.5 -2255.5	COAL	36	7	7	3	18	3	-	11	4	11	28	65WS
		DOM	33	-	-	-	-	-	-	13	-	54	15	35
61735 7400-7410	2255.5 -2258.6	COAL	39	16	2	2	2	-	-	15	-	24	46	54
		DOM	31	2	3	3	-	-	-	18	-	43	39	46
61736 7410-7420	2258.6 -2261.6	COAL	31	14	1	6	3	3	2	17	-	23	88	58
		DOM	30	5	1	6	1	-	-	17	2	36	64	42

TABLE 7.1 cont'd

MACUMBA NO.1 WELL
Maceral Analyses of the Coal and Dispersed Organic Matter
From the Lower to Middle Jurassic Sediments
Poolowanna Formation
(Results are given as percentages by volume unless otherwise stated)

Lab.No. Depth (feet)	Depth (metres)		Vitr-inite	Resinous Vitrinite	Sporinite	Cutinite	Resinite	Micr-inite	Macr-inite	Semi-fusinite	Fusi-nite	Inerto-detrinite	No. of counts	% Org-anic Matter
61737	2261.6	COAL	50	-	13	-	-	-	-	25	-	12	100	80WS
7420-7430	-2264.7	DOM	-	-	-	-	-	-	-	50	-	50	2	20
61738	2264.7	COAL	60	-	-	-	-	-	-	30	-	10	10	71WS
7430-7440	-2267.7	DOM	25	-	-	25	-	-	-	25	-	25	4	29
61739	2267.7	COAL	45	11	-	-	-	-	-	33	-	11	9	75WS
7440-7450	-2270.8	DOM	-	-	33	-	-	-	-	-	-	67	3	25
61740	2270.8	COAL	65	-	-	-	-	-	6	23	-	6	17	89WS
7450-7460	-2273.8	DOM	-	-	-	-	-	-	-	-	-	100	2	11
61741	2273.8	COAL	50	-	8	-	17	-	-	17	-	8	12	92WS
7460-7470	-2276.9	DOM	-	-	-	-	-	-	-	-	-	100	1	8
61742	2276.9	COAL	60	20	-	-	-	-	-	-	-	20	5	71WS
7470-7480	-2279.9	DOM	50	-	-	-	-	-	-	50	-	-	2	29
61743	2279.9	COAL	44	7	-	-	1	-	1	34	-	13	77	81
7480-7490	-2283.0	DOM	33	-	-	-	-	-	-	22	-	45	18	19
61744	2283.0	COAL	52	2	-	2	-	-	2	25	-	17	48	67
7490-7500	-2286.0	DOM	25	-	-	-	4	-	-	29	4	38	24	33

TABLE 7.1 cont'd

MACUMBA No.1 WELL
Maceral Analyses of the Coal and Dispersed Organic Matter
From the Lower to Middle Jurassic Sediments
Poolowanna Formation
(Results are given as percentages by volume unless otherwise stated)

Lab.No. Depth (feet)	Depth (metres)	Vitr- inite	Resinous Vitrinite	Sporinite	Cutinite	Resinite	Micr- inite	Macr- inite	Semi- fusinite	Fusi- nite	Inerto- detrinite	No. of Counts	% Org- anic Matter
617445 7500- 7510	2286.0 COAL -2289.1 DOM	33 75	- -	11 -	- -	- -	- -	- -	45 25	- -	11 -	9 4	69WS 31
61746 7510- 7520	2289.1 COAL -2292.1 DOM	- -	15 -	- -	14 8	- 8	14 -	- -	29 59	14 -	14 25	7 12	37WS 63

WS - whole sample
* includes alginite
All samples have been handpicked, except those marked Whole Sample (WS)

TABLE 7.2

POOLOWANNA NO.1 WELL
Middle to Lower Jurassic Coals and dispersed organic matter
Maceral Analyses
(Results are given as percentages by volume unless otherwise stated)

Lab. No. Depth (feet)	Depth (Metres)		Vitrinite	Resinous vitrinite	Sporinite	Cutinite	Resinite	Micrinite	Inerto-detrinite	Semi-fusinite	Fusinite	No. of Counts
59936 7910-20	2411.0-2414.0	COAL	71	2	2	tr	tr	1	9	15	tr	479
60450 7920	2414.0	COAL	72	1	2	1	5	1	8	10	tr	418
59937 7920-30	2414.0-2417.1	COAL	73	2	2	tr	tr	1	9	12	1	641
59938 7930-40	2617.1-2420.0	COAL	65	-	4	1	2	-	9	19	tr	366
7940-50	2420.1-2423.2	COAL	55	tr	2	1	-	tr	23	18	1	463
7950-60	2423.2-2426.2	COAL +DOM	42	5	1	3	2	-	23	24	-	161
7960-70	2426.2-2429.3	DOM	50	-	5	2	5	-	18	18	2	40
7980-90	2432.3-2435.4	DOM	71	3	-	4	1	-	10	8	3	151
7990-8000	2435.4-2438.4	COAL +DOM	68	5	-	1	3	tr	6	15	1	309
59945 8000-07	2438.4-2440.5	DOM	48	3	1	2	13	-	15	17	1	110
59946 8007-10	2440.5-2441.4	COAL	60	2	1	2	6	1	12	16	tr	361
59947 8010-20	2441.4-2444.5	COAL	78	2	1	tr	3	tr	10	6	-	398

TABLE 7.2 cont'd.

POOLOWANNA No.1 WELL
Middle to Lower Jurassic Coals and Dispersed Organic Matter
Maceral Analyses
(Results are given as percentages by volume unless otherwise stated)

Lab.No. Depth (feet)	Depth (metres)	Vitrinite	Resinous vitrinite	Sporinite	Cutinite	Resinite	Micrinite	Inerto-detrinite	Semi-fusinite	Fusinite	No. of counts
59948 8020-30	2444.5 2447.5 COAL	57	2	tr	3	7	-	15	15	1	341
59949 8030-40	2447.5- 2450.6 COAL	53	6	5	1	5	-	15	14	1	291
59950 8040-50	2450.6- 2453.6 COAL	63	3	2	1	5	-	9	17	-	369
59955 8090-8100	2465.8- 2468.9 COAL	60	1	2	1	2	2	16	14	2	550
59956 8100-8110	2468.9 2471.9 COAL	61	-	4	tr	3	1	18	11	2	303
59962 8160-8170	2487.2- 2490.2 COAL	65	3	tr	6	4	-	9	13	-	202
59963 8170-8180	2490.2- 2493.3 DOM	61	1	1	4	6	-	11	13	3	139
59965 8190-8200	2496.3 2499.4 COAL	60	6	6	2	9	-	6	10	1	412
59966 8200-8210	2499.4 2502.4 COAL	71	5	2	1	9	tr	4	8	tr	385
59967 8210-8220	2502.4- 2505.5 COAL	39	48	3	1	1	-	3	5	-	204
59975 8290-8300	2526.8- 2529.8 DOM	49	7	2	2	12	3	13	11	1	263
59980 8328.5-8340	2538.5- 2542.0 COAL	56	14	1	3	1	tr	4	20	1	172

TABLE 7.2 cont'd

POOLOWANNA No.1 WELL
Middle to Lower Jurassic Coals and Dispersed Organic Matter
Maceral Analyses
(Results are given as percentages by volume unless otherwise stated)

Lab.No. Depth (feet)	Depth (metres)		Vitrinite	Resinous vitrinite	Sporinite	Cutinite	Resinite	Micrinite	Inerto-detrinite	Semi-fusinite	Fusinite	No. of counts
59981 8340-8350	2542.0-2545.1	COAL	57	14	1	3	4	2	7	12	tr	449
59982 8350-8360	2545.1 2548.1	COAL	56	4	2	tr	2	-	14	21	1	479
60451 8350-8360	2545.1-2548.1	COAL	50	5	2	tr	4	1	13	23	2	585
59983 8360-8370	2548.1-2551.2	COAL	63	3	2	tr	2	2	10	16	2	314
59984 8370-8380	2551.2-2554.2	COAL	69	4	2	tr	2	3	10	9	1	583
59985 8380-8390	2554.2-2557.3	COAL	50	10	2	1	4	5	15	12	1	418
59986 8390-8400	2557.3-2560.3	COAL	65	6	2	-	2	2	12	11	-	447
60002 8400-8410	2560.3-2563.4	COAL	63	7	tr	tr	2	1	18	9	tr	242
60003 8410-8420	2563.4-2566.4	COAL	44	3	2	4	3	3	17	22	2	292
60004 8420-8430	2566.4-2569.5	DOM	18	13	1	3	4	3	32	25	1	146
59763 8430(core)	2569.5	DOM	25	-	7	8	13	-	37	7	3	84
59762 8441(core)	2572.8	DOM	34	-	7	3	10	1	28	17	-	151

TABLE 7.2 cont'd

POOLOWANNA NO.1 WELL
Middle to Lower Jurassic Coals and Dispersed Organic Matter
Maceral Analyses
(Results are given as percentages by volume unless otherwise stated)

Lab.No. Depth (feet)	Depth (metres)		Vitrinite	Resinous vitrinite	Sporinite	Cutinite	Resinite	Micrinite	Inerto-detrinite	Semi-fusinite	Fusinite	No. of counts
60598 8441(core)	2572.8	DOM	40	2	-	14	12	1	13	17	1	164
60008 8443-8450	2573.4-2575.6	COAL	53	2	2	10	1	2	10	19	1	370
8500-8510 (+Triassic)	2590.8-2593.8	DOM	30	5	1	10	2	1	30	19	2	167

tr = trace

TABLE 7.3

MACUMBA NO.1 WELL
Upper Jurassic
Algebuckina Formation
Maceral analyses of the organic matter

Lab No. Depth (feet)	Depth (metres)	Vitrinite		Suberinite	Sporinite	Cutinite	Resinite/ Liptodetr-inite	Macrinite	Micrinite	Inerto-detrinite	Semi-fusinite	Fusin-ite	No. of Counts
61609	1475.2	COAL	73	11	-	8	4	-	tr	1	3	-	367
4840-70	-84.4	DOM	-	-	-	-	-	-	-	75	25	-	4*
61633	1694.7	COAL	46	13	tr	3	5	3	tr	1	26	3	449
5560-90	-1703.8	DOM	67	-	-	-	33	-	-	-	-	-	3*
61634	1703.8	COAL	52	10	3	1	4	3	-	2	24	1	373
5590-	-13.0	DOM	15	-	8	-	-	-	-	77	-	-	13
5620													
61638	1740.4	COAL	69	12	7	1	2	-	1	5	3	-	272
5710-40	-49.6						NO DOM						
61639	1749.6	COAL	76	7	6	1	tr	tr	2	6	2	tr	584
5740-70							NO DOM						
61640	1758.7	COAL	65	12	7	1	1	tr	2	9	3	tr	324
5770-	-67.8	DOM	13	-	47	20	7	-	-	13	-	-	15
5800													
61658	1923.3	COAL	72	22	-	2	3	-	-	-	1	-	124
6310-40	-32.4	DOM	31	20	22	7	$5+2^{+}$	-	2	9	2	-	55HP
Hand Picked													
61661	1950.7	COAL	62	22	2	2	3	-	-	2	7	-	184
6400-30	-59.9	DOM	17	-	50	-	$8+8^{+}$	-	-	-	17	-	12
61662	1959.9	COAL	97	-	tr	-	3	-	-	tr	-	-	683
6430-60	-69.0	DOM	50	-	-	?	50	-	-	-	-	-	4*
61674	2069.6	COAL	78	2	4	3	5	-	2	4	1	1	398
6790-	-72.6	DOM	38	-	25	-	12	-	-	25	-	-	8*
6800													

TABLE 7.3 cont'd

MACUMBA NO.1 WELL
Upper Jurassic
Algebuckina Formation
Maceral analyses of the organic matter

Lab.No. Depth (feet)	Depth (metres)		Vitrinite	Suberinite	Sporinite	Cutinite	Resinite/ Liptodetr-inite	Macrinite	Micrinite	Inerto-detrinite	Semi-fusinite	Fusin-ite	No. of counts
61689	2115.3	COAL	91	-	1	-	3	3	-	-	-	2	138
6940-50	-18.4	DOM	75	-	-	-	-	-	-	25	-	-	4*
61693	2127.5	COAL	81	8	1	1	1	1	-	2	5	-	272
6980-90	-30.6	DOM	16	-	32	16	-	-	-	32	4	-	19
61694	2130.6	COAL	98	-	-	tr	1+	-	-	1	-	-	305
6990-7000	-33.6	DOM	-	-	50	-	-	-	-	50	-	-	2*
61697	2139.7	COAL	55	7	8	3	8	tr	2	11	5	1	502
7020-30	-42.7	DOM	4	-	29	4	-	-	-	38	25	-	24
61712	2185.4	COAL	65	1	2	1	3	tr	1	12	15	tr	678
7170-80	-88.5	DOM	23	-	11	-	-	-	-	33	33	-	9*

+ includes algae

* too few counts for meaningful results

TABLE 7.4

POOLOWANNA NO.1 WELL
Upper Jurassic Coals and Dispersed Organic Matter
Algebuckina Formation
Maceral Analyses
(Results are given as percentages by volume unless otherwise stated)

Lab.No. Depth (feet)	Depth (Metres)		Vitrinite	Suberinite	Sporinite	Cutinite	Resinite	Micrinite	Inerto-detrinite	Semi-fusinite	Fusinite	No. of counts
1.60487 5560-70	1694.7-1697.7	COAL	90	7	-	3	tr	-	-	-	-	212
2.60446 5650	1722.1	DOM	86	12	-	-	-	-	-	2	-	67
3.60514 5830-40	1777.0-1780.0	DOM	80	3	-	-	3	-	3	11	-	35
4.60541 6100-10	1859.3-1862.3	DOM	79	-	-	5	3	-	-	13	-	60
5.60447 6300	1920.2	DOM	93	7	-	-	-	-	-	-	-	95
6.6390-6400	1947.7-1950.7	COAL	98	tr	-	-	-	-	1	1	-	206
7.60448 6400	1950.7	DOM	98	2	-	-	-	-	-	-	-	66
8.59767-70 6600-40	2011.7-2023.9	COAL	81	7	4	2	3	-	1	2	-	249
9.59800-04 6930-80	2112.3-2127.5	DOM	89	-	-	7	2	-	-	2	-	92
10.59878 7330-40	2234.2-2237.2	DOM	90	4	-	-	1	-	4	1	-	113
11.59904 7590-7600	2313.4-2316.5	COAL	54	-	6	1	19	-	8	12	-	376

TABLE 7.4 cont'd

POOLOWANNA NO.1 WELL
Upper Jurassic Coals and Dispersed Organic Matter
Algebuckina Formation
Maceral Analyses
(Results are given as percentages by volume unless otherwise stated)

Lab.No. Depth (feet)	Depth (Metres)		Vitrinite	Suberinite	Sporinite	Cutinite	Resinite	Micrinite	Inerto-detrinite	Semi-fusinite	Fusinite	No. of counts
12.60449 7595	2315.0	COAL	51	10	3	tr	15	2	12	7	-	453
13.60595 7729	2355.8	COAL	64	34	-	-	2	-	-	-	-	271
14.59760 7729.25-7729.50	2355.9-2356.0	DOM	81	9	-	-	4	-	3	3	-	127
15.59761 7753.17-7753.42	2363.2-2363.3	DOM	78	-	-	-	7	-	1	14	-	139
16.60595 7758	2364.6	COAL	98	1	-	-	1	-	-	-	-	227

tr = trace

TABLE 7.5

MACUMBA NO.1 WELL
Lower Cretaceous
Oodnadatta Formation
Maceral analyses of the organic matter

Lab.No. Depth (feet)	Depth (metres)		Vitrinite	Resinous Vitrinite	Sporinite	Cutinite	Suberinite/ Resinite/ Liptodetri-nite	Macr-inite	Micr-inite	Inerto-detri-nite	Semi-fus-inite	Fusi-nite	No. of Counts
61527	710.2	COAL	91	5	1	-	3	-	-	tr	tr	-	288
2330-60	-19.3	DOM	-	34	-	-	-	-	-	33	33	-	3*
61535	783.3	COAL	64	15	1	1	19	-	-	-	-	-	303
2570-2600	-92.5												
61574	1158.2	COAL	52	5	8	4	22	1	-	5	3	-	142
3800-30	-67.4												

* too few counts for meaningful results

TABLE 7.6

MACUMBA NO.1 WELL
Upper Cretaceous
Winton Formation
Maceral analyses of the organic matter

Lab.No. Depth (feet)	Depth (metres)		Vitrinite	Resinous Vitrinite	Sporinite	Cutinite	Suberinite/ Resinite/ Liptodetri- inite	Macr- inite	Micr- inite	Inerto- detr- inite	Semi- fus- inite	Fusi- nite	No. of Counts
61467 540-70	164.6- 73.7	COAL	85	9	-	-	4	-	-	-	1	1	173
61468 570-600	173.7- 82.9	COAL	88	6	-	-	2	-	-	1	3	-	337
61469 600-30	182.9- 92.0	COAL	87	10	-	tr	-	-	tr	-	3	-	480
61470 630-60	192.0- 201.2	COAL	74	17	-	1	1	-	tr	2	4	1	309
61471 660-90	201.2- 10.3	COAL	86	7	-	1	2	-	tr	3	1	tr	341
61472 690-720	210.3- 19.5	COAL	76	12	-	-	2	1	2	1	5	1	311
61473 720-50	219.5- 28.6	COAL	82	12	-	-	3	-	1	tr	1	1	351
61478 870-90	265.2- 71.3	COAL	81	9	-	-	7	tr	tr	1	2	tr	307
61479 890-920	271.3- 80.4	COAL	75	17	-	-	7	-	-	1	-	-	125
		DOM	-	-	-	-	-	-	-	100	-	-	1*
61480 920-50	280.4- 89.6	COAL	92	3	tr	-	2	-	-	tr	2	1	357
51483 1020-50	310.9- 20.0	COAL	77	9	-	2	3	-	-	1	4	4	201
		DOM	33	-	-	67	-	-	-	-	-	-	3*
61484 1050-80	320.0- 29.2	COAL	82	8	tr	-	2	-	tr	tr	5	3	264

TABLE 7.6 cont'd

MACUMBA NO.1 WELL
Upper Cretaceous
Winton Formation
Maceral analyses of the organic matter

Lab.No. Depth (feet)	Depth (metres)		Vitrinite	Resinous Vitrinite	Sporinite	Cutinite	Suberinite/ Resinite/ Liptodetri-inite	Macr-inite	Micr-inite	Inerto-detr-inite	Semi-fus-inite	Fusi-nite	No. of Counts
61485	329.2-	COAL	89	1	-	1	2	-	-	1	5	1	223
1080-1110	38.3	DOM	50	-	-	-	-	-	-	-	50	-	2*
61517	618.8-	COAL											
2030-60	27.9		80	7	-	1	1	1	tr	-	9	1	354
61519	637.0-	COAL	61	5	3	tr	2	-	1	12	15	1	393
2090-2120	46.2	DOM	32	-	11	-	-	-	-	23	27	7	44
61520	646.2-	COAL	72	3	3	-	3	-	1	7	10	1	188
2120-50	55.3	DOM	11	-	4	4	-	-	-	42	31	8	26
61523	673.6-	COAL	81	4	2	1	4	-	1	3	2	2	226
2210-40	82.8	DOM	50	-	-	-	-	-	-	50	-	-	4*

* too few counts for meaningful results

tr = trace

TABLE 7.7

POOLOWANNA No.1 WELL - CRETACEOUS
Winton, Oodnadatta and Bulldog Formations
Maceral Analysis of the Subsections
(Results are given as percentages by volume unless otherwise stated)

Lab. No. Depth (feet)	Depth (Metres)	Vitrinite	Suberinite	Sporinite	Cutinite	Resinite	Micrinite	Inerto-detrinite	Semi-fusinite	Fusinite	No.of counts
					WINTON FORMATION						
60312 910-940	277.4 COAL -286.5	86	1	-	1	4	-	2	5	1	292
60441 1220-1300	365.8 COAL -396.2	100	-	-	-	-	-	-	-	-	132
60442 2000-2100	609.6 COAL -640.1	96	1	-	-	1	-	-	2	-	325
60349 2020-2050	615.7 COAL -624.8	82	2	-	3	2	tr	2	7	2	237
60359 2320-2350	707.1 COAL -716.3	81	2	tr	4	3	tr	3	5	2	330
60443 2500-2600	762.0 COAL -792.5	82	6	1	2	5	-	1	3	-	234
60368 2770-2800	844.3 COAL -853.4	70	3	6	1	8	-	6	6	tr	524
					OODNADATTA FORMATION						
60444 2800	853.4 COAL	60	3	6	1	15	tr	8	6	1	576
60389 3400-3430	1036.3 DOM -1045.6	66	3	-	2	12	-	3	12	2	65
60145 3950	1204.0 COAL	95	3	-	-	1	-	-	1	-	372
60411 4060-4090	1237.5 DOM -1246.6	61	6	-	8	4	-	5	15	1	82
					BULLDOG FORMATION						
60429 4600-4630	1402.1 DOM -1411.2	29	5	2	11	37	-	5	9	2	85
60458 5140-5170	1566.7 DOM -1575.8	55	1	11	11	4	-	7	8	3	73

tr = trace

TABLE 7.8

MACUMBA NO.1 WELL
Microlithotype Analyses of the Lower to Middle Jurassic Cuttings
Poolowanna Formation
(Results are given as percentages by volume unless otherwise states)

Lab.No. Depth (feet)	Depth (metres)	Vitr ite	Clarite	Intermediates	¶ Durite	Semi fusite + Fusite	No. of Counts
61713 7180-7190	2188.5 -2191.5	59	1	14	10	16	447
61714 7190-7200	2191.5 -2194.6	52	2	5	28	13	563
61715 7200-7210	2194.6 -2197.6	75	1	4	12	8	394
61716 7210-7220	2197.6 -2200.7	38	2	6	29	25	347
61717 7220-7230	2200.7 -2203.7	52	13	1	16	18	256
61718 7230-7240	2203.7 -2206.8	70	13	5	5	7	163
61719 7240-7250	2206.8 -2209.8	29	17	10	14	30	161
61720 7250-7260	2209.8 -2212.9	45	10	28	2	15	443
61721 7260-7270	2212.9 -2215.9	52	9	29	2	8	480
61722 7170-7280	2215.9 -2218.9	57	10	18	6	9	604
61723 7280-7290	2218.9 -2222.0	54	8	23	4	11	455
61724 7290-7300	2222.0 -2225.0	54	7	19	5	15	270
61725 7300-7310	2225.0 -2228.1	33	12	40	2	13	224
61726 7310-7320	2228.1 -2231.1	63	19	12	1	5	272
61727 7320-7330	2231.1 -2234.2	72	12	12	1	3	423
61728 7330-7340	2234.2 -2237.2	38	27	30	2	3	331
61729 7340-7350	2237.2 -2240.3	42	17	23	5	13	194
61730 7350-7360	2240.3 -2243.3	41	22	27	2	8	199
61731 7360-7370	2243.3 -2246.4	45	10	34	4	7	143

TABLE 7.8 cont'd

MACUMBA NO.1 WELL
Microlithotype Analyses of the Lower to Middle Jurassic Cuttings
Poolowanna Formation
(Results are given as percentages by volume unless otherwise stated)

Lab.No. Depth (feet)	Depth (metres)	Vitrite	Clarite	Intermediates	¶ Durite	Semi-fusite + Fusite	No. of Counts
61733 7380-7390	2249.4 -2252.5	25	8	17	26	24	147
61736 7410-7420	2258.6 -2261.6	33	9	20	17	21	79
61743 7480-7490	2279.9 -2283.0	44	1	8	13	34	77

¶ includes microite and inertodetrite

TABLE 7.9

POOLOWANNA NO.1 WELL

Microlithotype analyses of the Middle to Lower Jurassic coals

(Results are given as percentages by volume unless otherwise stated)

Depth (feet)	Depth (metres)	Vitr-ite	Clar-ite	Inter-med-iates	Microite + Durite	Semi-fusite + Fusite	No. of counts
59936 7910-7920	2411.0- 2414.0	65 67	1 1	16 17	2 2	13 13	485
60450 7920	2414.0	63	5	19	2	11	416
59937 7920-30	2414.0- 2417.1	62 63	3 3	19 19	2 2	13 13	685
59938 7930-40	2417.1- 2420.1	51 53	9 9	19 20	3 3	14 15	541
7940-50	2420.1- 2423.2	39 41	4 4	25 26	11 11	18 18	449
7950-60	2423.2 2426.2	33 39	7 9	17 20	10 11	17 21	124
7960-70	2426.2 2429.3	not enough material for microlithotypes					
7980-90	2432.3- 2435.4	61 66	4 4	6 6	3 3	19 21	121
7990-8000	2435.4- 2438.4	59 66	5 5	6 6	2 2	18 21	277
59945 8000-07	2438.4- 2440.5	not enough material for microlithotypes					
59946 8007-10	2440.5- 2441.4	34 52	2 3	12 17	8 12	10 16	332
59947 8010-20	2441.4- 2444.5	56 73	4 5	10 13	3 4	4 5	412
59948 8020-30	2444.5- 2447.5	27 51	3 6	6 11	5 10	12 22	269
59949 8030-40	2447.5- 2450.6	24 36	7 11	24 37	3 5	7 11	254
59950 8040-50	2450.6- 2453.6	39 56	6 8	9 13	5 7	11 16	393
59955 8090-8100	2465-8 2468.9	49 50	4 4	32 32	3 3	11 11	517
59956 8100-8110	2468.9- 2471.9	55 56	3 3	28 28	6 6	7 7	243
59962 8160-8170	2487.2- 2490.2	49 59	5 7	13 15	5 6	11 13	154
59963 8170-8180	2490.2- 2493.3	not enough material for microlithotypes					
59965 8190-8200	2496.3- 2499.4	38 46	26 31	8 9	2 2	10 12	364
59966 8200-8210	2499.4- 2502.4	49 55	24 27	10 10	tr tr	8 8	350

TABLE 7.9 (cont'd)

Poolowanna No.1

Microlithotype Analyses of Middle to Lower Jurassic Coals

Poolowanna Formation

(Results are given as percentages by volume unless otherwise stated)

Lab. No. Depth (feet)	Depth (metres)	Vitrite	Clarite	Intermediates	Durite	Fusite	No. of counts
59967 8210-8220	2502.4- 2505.5	83	3	7	1	6	278
59980 8328.5-8340	2538.5- 2542.0	57	10	7	5	21	146
59981 8340-8350	2542.0- 2545.1	58	9	22	5	6	426
59982 8350-8360	2545.1- 2548.1	51	3	24	4	18	601
60451 8350-8360	2545.1- 2548.1	44	4	23	4	25	508
59983 8360-8370	2548.1- 2551.2	51 54	10 10	18 19	2 3	13 14	305
59984 8370-8380	2551.2- 2554.2	57 60	5 6	21 22	6 6	6 6	532
59985 8380-8390	2554.2- 2557.3	46 50	5 5	23 25	11 12	7 8	357
59986 8390-8400	2557.3- 2560.3	61 64	5 5	14 15	5 5	10 11	402
60002 8400-8410	2560.3- 2563.4	48 53	4 4	16 17	16 17	7 9	204
60003 8410-8420	2563.5- 2566.4	36 39	5 6	21 23	10 12	19 20	279
8443-8450	2573.4- 2575.6	34	21	23	4	18	367

TABLE 7.10

MACUMBA NO.1 WELL

Upper Jurassic

Algebuckina Formation

Microlithotype Analyses of the Cuttings

(Results are given as percentages by volume unless otherwise stated)

Lab.No. Depth (feet)	Depth (metres)	Vitrite	Liptite+ Clarite	Intermediates	Microite+ Durite+ Macroite	Semi-fusite + Fusite	No.of counts
61609 4840-70	1475.2 -84.4	80	17	tr	-	3	259
61633 5560-90	1694.7 -1703.8	46	17	2	7	28	367
61634 5590-5620	1703.8 -13.0	45	17	3	7	28	329
Seam Average		46	17	2	7	28	
61638 5710-40	1740.4 -49.6	51	27	20	-	2	300
61639 5740-50	1749.6 -58.7	69	10	19	1	1	504
61640 5770-5800	1758.7 -67.8	68	8	19	2	3	322
Seam Average		62	16	19	1	2	
61658 6310-40	1923.3 -32.4	90	8	2	-	-	205
61661 6400-30	1950.7 -59.9	87	9	2	-	2	193
61662 6430-60	1959.9 -69.9	94	6	-	-	-	341
Seam Average		91	7	1	-	1	
61674 6790-6800	2069.6 -72.6	63	20	12	1	4	415
61689 6940-50	2115.3 -18.4	80	11	-	9	-	70
61693 6980-90	2127.5 -30.6	80	11	2	3	4	264
61694 6990-7000	2130.6 -33.6	96	-	3	-	1	142
Seam Average		90	4	3	1	2	
61697 7020-30	2139.7 -42.7	40	36	14	7	4	548
61712 7170-80	2185.4 -88.5	66	2	6	15	11	523

TABLE 7.11

MACUMBA NO.1 WELL

Lower Cretaceous

Oodnadatta Formation

Microlithotype Analyses of the Cuttings

(Results are given as percentages by volume unless otherwise stated)

Lab.No. Depth (feet)	Depth (metres)	Vitr-ite	Liptite+ Clarite	Inter-med-iates	Microite+ Durite+ Macroite	Semi-fusite+ Fusite	No. of counts
61527 2330-60	710.2 -19.3	90	10	-	-	tr	295
61535 2570-2600	783.3 -92.5	65	35	-	-	-	313
61574 3800-30	1158.2 -67.4	43	31	21	5	-	159

tr = trace

TABLE 7.12

MACUMBA NO.1 WELL

Upper Cretaceous
Winton Formation

MICROLITHOTYPE ANALYSES OF THE CUTTINGS

(Results are given as percentages by volume unless otherwise stated)

Lab.No. Depth (feet)	Depth (metres)	Vitr-ite	Liptite+ Clarite	Inter-med-iates	Microi te+ Durite+ Macroite	Semifus-ite+ fusite	No. of counts
61467 540-70	164.6 -73.7	90	5	1	1	3	210
61468 570-600	173.7 -82.9	94	3	-	-	3	337
61469 600-30	182.9 -92.0	94	3	2	-	1	261
61470 630-60	192.0 -201.2	84	4	6	-	6	340
61471 660-90	201.2 -10.3	89	4	6	-	1	381
61472 690-720	210.3 -19.5	84	4	7	-	5	357
61473 720-50	219.5 -28.6	87	10	1	-	2	341
Seam Average		88	5	4	tr	3	
61478 870-90	265.2 -71.3	85	8	2	-	5	295
61479 890-920	271.3 -80.4	80	15	4	-	1	154
61480 920-50	280.4 -89.6	96	tr	1	-	3	400
Seam average		87	8	2	-	3	
61483 1020-50	310.9 -20.0	78	8	2	-	12	256
61484 1050-80	320.0 -29.2	87	3	3	tr	7	302
61485 1080-1110	329.2 -38.3	85	6	4	-	5	259
Seam average		84	5	3	tr	8	
61517 2030-60	618.8 -27.9	84	4	-	1	11	368

TABLE 7.12 (continued)

MACUMBA NO.1 WELL

Upper Cretaceous
Winton Formation

MICROLITHOTYPE ANALYSES OF THE CUTTINGS
(Results are given as percentages by volume unless otherwise stated)

Lab.No. Depth (feet)	Depth (metres)	Vitr-ite	Liptite+ Clarite	Inter-med-iates	Microite+ Durite+ Macroite	Semifus-ite+ fusite	No.of counts
61519 2090-2120	637.0 -46.2	57	7	15	6	15	344
61520 2120-50	646.2 -55.3	70	4	11	2	13	290
Seam Average		63	6	13	4	14	
61523 2210-40	673.6 -82.8	76	10	7	2	5	380

TABLE 7.13

UPPER JURASSIC COALS FROM POOLOWANNA NO.1 WELL

Algebuckina Formation

Microlithotype analyses
(Results are given as percentages by volume unless otherwise stated)

Lab.No. Depth (feet)	Depth (metres)	Vitrite	Clarite	Intermediates	Microite + Durite	Semifusite + Fusite	No. of counts
59767-70 6600-40	1011.7 -2023.9	77	22	1	-	-	150
59904 7590-7600	2313.4 -2316.5	40	13	30	11	6	466
60449 7595	2315.0	39	10	32	14	5	402
59760 7729.25 -7729.50	2355.9 -2356.0	96	1	-	-	3	117
59761 7753.17 -7753.42	2363.2 -2363.3	82	2	2	-	14	134

TABLE 7.14

POOLOWANNA NO.1 WELL

Microlithotype analyses of coals of Cretaceous age

(Results are given as percentages by volume unless otherwise stated)

Lab.No. Depth (feet)	Depth (metres	Vitrite	Clarite	Intermediates	Microite + Durite	Semifusite + Fusite	No. of counts
				WINTON FORMATION			
60312 910-940	277.4 -286.5	85	6	tr	tr	9	288
60441 1200-1300	365.8 -396.2	100	-	-	-	-	132
60442 2000-2100	609.6 -640.1	97	-	-	-	3	355
60349 2020-2050	615.7 -624.8	69	14	7	2	8	243
60359 2320-2350	707.1 -716.3	79	12	1	1	7	314
60443 2500-2600	762.0 -792.5	87	8	-	3	2	111
				OODNADATTA FORMATION			
60368 2770-2800	844.3 -853.4	63	16	14	4	3	482
60444 2800	853.4	48	22	20	4	6	485
60445 3950	1204.0	99	1	-	-	tr	402

tr = trace

APPENDIX 3.1

Fly Lake No.1 Well, Cooper Basin

Descriptions of dispersed organic matter in the interseam sediments.

1. 2578.2 metres   8458.5 feet   LN 43281

Carbonaceous siltstone - Grey siltstone with carbonaceous layers.

Transmitted light (TS 23927)

Carbonaceous material forms about 5% of the rock, occurring predominantly as fragments, from a few microns, to several hundreds of microns, in size. Approximately 95% of the organic material is opaque : where the fragments are transparent they are generally brown in colour. Very rare, three-dimensional brown spores are present.

Fluorescence Mode (B.27361)

Extremely rare microspores occur in the finer-grained lenses.

2. 2580.4 metres   8466 feet   LN 43282

White sandstone with carbonaceous lenses.

Transmitted light (TS 23928)

Carbonaceous material is very scarce; there are rare, transparent brown patches and fragments, less than 50 microns in size. The grains are closely compacted, some having a thin film of brown material rimming them.

Fluorescence Mode (B.27362)

No exinite apparent.

3. 2585.2 metres   8481.5 feet   LN 43284

White sandstone with carbonaceous partings.

Transmitted light (TS 23930)

The grains are tightly compacted with a little clay and micaceous material between some of them. There is very little carbonaceous matter, mostly opaque. It occurs in the finer-grained minerals between the quartz grains. There are occurrences of brown transparent organic matter squeezed along grain boundaries. Overall the organic matter content is 1%.

Fluorescence Mode (B.27363)

No exinite apparent.

4. 2680.7 metres   8795 feet   LN 43285

Dark grey siltstone.

Transmitted light (TS 23931)

The rock contains approximately 5% carbonaceous matter, mostly in the form of opaque stringers. There are very rare, brown, transparent fragments and patches, often circular in outline, generally 50 microns in size.

Fluorescence Mode (B.27364

No exinite apparent

5. 2685.6 metres   8811 feet   LN 43287

Fine sandstone/siltstone with carbonaceous partings.

Transmitted light (TS 23933)

There is quite a high proportion of argillaceous and micaceous cementing material between the grains of this sandstone, and dispersed organic matter occurs in this. The organic material is mostly opaque fragments some of them up to 200 microns, but generally about 50 microns. It forms approximately 1% of the rock and very little of it is transparent.

Fluorescence Mode (B.27365)

No exinite apparent.

6. 2688.9 metres 8822 feet LN 43288

White sandstone

Transmitted light (TS 23934)

The quartz grains are closely packed with very little cementing material. There is virtually no carbonaceous matter.

Fluorescence Mode (B.27366)

No exinite apparent.

7. 2691.4 metres 8830 feet LN 43289

Black carbonaceous shale with leaf impressions.

Transmitted light (TS 23935)

Masses of fossil leaves are visible. Dispersed organic matter is abundant, probably about 25% of the rock, mostly in fine fragments of 20-30 micron size, but also much larger stringers, centimetres long. Most of the fragments are opaque, and any transparent material is brown.

Fluorescence Mode (B.27367)

The sample contains a lens of coal in which exinite is plentiful as spores and cuticles (5%). There does not appear to be any exinite in the surrounding rock.

8. 2691.4 metres 8830 feet LN 47238

Black carbonaceous shale with pale silty lenses.

Fluorescence Mode (B.27360)

Microspores and cuticles are plentiful (2-3% of the more carbonaceous areas). In the silty lenses, only microspores are present, 1%. Cuticles are associated with vitrinite-type material in the carbonaceous lenses. The overall exinite content is 1-2%.

9. <u>2692.0 metres</u> <u>8832 feet</u> <u>LN 43290</u>

Black mudstone with conchoidal fracture.

<u>Transmitted light</u> (TS 23936)

This rock contains about 35% dispersed organic matter, mostly as fine opaque fragments, 50 microns in size. There are also macroscopically visible fragments. Where the section is very thin, transparent material is dark brown.

<u>Fluorescence Mode</u> (B.27368)

No exinite apparent. Many of the opaque fragments appear to be vitrinite.

10. <u>2701.1 metres</u> <u>8862 feet</u> <u>LN 43292</u>

Black silty shale/siltstone.

<u>Transmitted light</u> (TS 23938)

Dispersed organic matter forms 25% of the rock. It is fairly coarse fragments and stringers, well aligned with the bedding. The organic matter is predominantly opaque; transparent material is brown.

<u>Fluorescence Mode</u> (B.27369)

There are very rare microspores and extremely rare algae. The carbonaceous fragments are mostly vitrinite and some inertinite.

11. <u>2706.9 metres</u> <u>8881 feet</u> <u>LN 43293</u>

White sandstone with carbonaceous patches.

<u>Transmitted light</u> (TS 23939)

Quartz and other detrital grains are tightly packed with very little cementing material. There is virtually no dispersed organic matter, except for a few transparent fragments and some thin yellowish staining around the edges of some grains.

Fluorescence Mode (B.27370)

No exinite apparent.

12. 2718.8 metres 8920 feet LN 43294

Laminated dark grey and white siltstone/sandstone.

Transmitted light (TS 23940)

There is about 5% dispersed organic matter in the silty layers, none in the sandstone, giving about 2% overall. The layers are a millimetre or so thick. The organic matter occurs in fairly coarse fragments or stringers, mostly opaque. There are some transparent stringers and small circular bodies (50 microns).

Fluorescence Mode (B.27371)

Carbonaceous fragments are plentiful, but microspores are associated with only a few of those fragments. Exinite 1%. Many of the opaque fragments appear to be vitrinite.

13. 2840.7 metres 9320 feet LN 43296

Grey mudstone with leaf impressions.

Transmitted light (TS 23942)

Dispersed organic matter forms about 5% of the rock. It is fine, the fragments being generally 20-30 microns, up to 50 microns, and mostly opaque. There are rare, brown transparent fragments.

Fluorescence Mode (B.27372)

No exinite apparent. Fragments are mostly vitrinite.

14. 2849.9 metres 9350 feet LN 43298

Brown sandstone.

Transmitted light (TS 23944)

The quartz grains are tightly packed, with little cementing material. Only a few transparent fragments of organic matter occur.

Fluorescence Mode (B.27375)

No exinite apparent.

15. 2863.3 metres 9394 feet LN 43299

Black carbonaceous silty shale.

Transmitted light (TS 23945)

This rock contains about 20% dispersed organic matter as opaque stringers from a few microns to millimetres in length. The longer stringers appear to be vitrinite. Some of the finer material is transparent, brown.

Fluorescence Mode (B.27376)

Microspores are dispersed through the finer-grained lenses, 1-2% and have quite low fluorescence. The thick coaly lenses are generally seimfusinite, the finer streaks are vitrinite.

16. 2871.1 metres 9419.5 feet LN 43300

Grey siltstone with paler sandy lenses.

Transmitted light (TS 23946)

Dispersed organic matter forms 2-10% of the silty lenses; there is very little in the sandy lenses, giving about 2% overall content. The organic matter is mostly opaque stringers; a few which are partly transparent are brown.

Fluorescence Mode (B.27377)

There are rare microspores, and fragments of semifusinite and vitrinite.

17. 2871.2 metres 9420 feet LN 43301

White sandstone.

Transmitted light (TS 23947)

There is very little dispersed organic matter, just a few transparent patches and wisps between the grains.

Fluorescence Mode (B.27378)

No exinite apparent.

18. 2881.1 metres 9452.5 feet LN 43302

Buff siltstone.

Transmitted light (TS 23948)

There is 1% dispersed organic matter, opaque fragments 100 microns in size.

Fluorescence Mode (B.27379)

No exinite apparent.

APPENDIX 3.2

Fly Lake No.2 Well, Cooper Basin

Descriptions of the dispersed organic matter in the interseam sediments.

1. 2682.2 metres   8800 feet   LN 43303

Dark grey carbonaceous siltstone, conchoidal fracture, with paler, non-carbonaceous lenses.

Transmitted light (TS 24232)

The organic material occurs in layers where it forms about 25% of the rock. It occurs in long stringers, wrapped around grains and as fragments. Almost all of it is opaque, with perhaps 10% transparent material, orange-brown to brown. The pale areas of the rock contain only a few fragments of carbonaceous material. The layers are a few hundred microns to several millimetres in width. Overall the organic content is approximately 10%.

Fluorescence Mode (B.27326)

Microspores are dispersed through the rock but are sparse (1%). There are also algae through the rock, rather rare, occurring singly and 20-100 microns in size. Neither the spores nor algae are present in the sand lenses. Cuticles are even rarer than the algae.

2. 2691.4 metres   8830 feet   LN 43305

Laminated carbonaceous/non-carbonaceous shale.

Transmitted light (TS 24233)

Dispersed organic matter forms up to 20% of the carbonaceous layers, and is virtually absent from the pale layers. The overall organic content is about 5%. It occurs as fine stringers, up to 100 microns long, and fine fragments, down to a few microns in size. The organic matter is mostly opaque, but there is about 30% transparent material.

Fluorescence Mode (B.27327)

Microspores occur through the rock (1%). Algae are also present, although not as many as above, and they tend to be smaller in size (50 microns average). They are more orange coloured than those above in general, with only a few of the larger bright yellow ones.

3. 2693.5 metres 8837 feet LN 43306

Sandstone with macroscopic streaks of carbonaceous material.

Transmitted light (TS 24234)

No dispersed organic matter is visible in the thin section.

Fluorescence Mode (B.27328)

No exinite apparent.

4. 2703.6 metres 8870 feet LN 43309

Micaceous siltstone, subconchoidal fracture.

Transmitted light (TS 24235)

There is about 2% dispersed organic matter scattered through the rock, not layered. There are very long continuous streaks which may be rootlets, and fragments from a few microns to 300 microns in size. Most of the fragments are opaque with a few brown transparent ones.

Fluorescence Mode (B.27329)

No exinite apparent.

5. 2708.8 metres 8887 feet LN 43310

Sandstone with macroscopic lenses of carbonaceous material.

Transmitted light (TS 24236)

Stringers of carbonaceous material are squeezed along grain boundaries, from very fine wisps to ones macroscopically visible. They are generally opaque. The total organic content is 1%.

Fluorescence Mode (B.27330)

No exinite apparent.

6. 2710.6 metres 8893 feet LN 43311

Sandstone with carbonaceous lenses.

Transmitted light (TS 24237)

There is very little dispersed organic matter, just a few wisps around grains.

Fluorescence Mode (B.27331)

No exinite apparent.

7. 2712.7 metres 8900 feet LN 43312

Carbonaceous siltstone.

Transmitted light (TS 24238)

The carbonaceous matter is scattered randomly through the rock with no obvious bedding planes. It occurs mostly as opaque fragments from a few microns to 200 microns in size, and forms approximately 5% of the rock. About 10% of the dispersed organic matter is transparent, orange to brown in colour.

Fluorescence Mode (B.27332)

Extremely rare microspores with fairly weak fluorescence.

8. 2749.6 metres 9021 feet LN 43314

Sandstone with carbonaceous lenses.

<u>Transmitted light</u> (TS 24240)

There is very little microscopic dispersed organic matter, just a few opaque and transparent fragments.

<u>Fluorescence Mode</u> (B.27333)

No exinite apparent.

9. <u>2761.2 metres</u> <u>9059 feet</u> <u>LN 43315</u>

Carbonaceous siltstone with fossil leaves.

<u>Transmitted light</u> (TS 24241)

There is about 2-3% dispersed organic matter, as fragments and stringers, mostly opaque.

<u>Fluorescence Mode</u> (B.27334)

Extremely rare, weakly fluorescing microspores.

10. <u>2804.5 metres</u> <u>9201 feet</u> <u>LN 43316</u>

Very carbonaceous lithic sandstone.

<u>Transmitted light</u> (TS 24242)

The organic matter is macroscopically visible in stringers up to a few millimetres wide and a centimetre or so long. These are generally opaque but often transparent on edges, so may be vitrinite-type material. They occur wrapped around and between clastic grains and form about 5% of the rock.

<u>Fluorescence Mode</u> (B.27335)

No exinite apparent.

11. <u>2813.3 metres</u> <u>9230 feet</u> <u>LN 43318</u>

Sandstone with carbonaceous lenses.

<u>Transmitted light</u> (TS 24243)

There is very little dispersed organic matter, but macroscopic stringers, mostly opaque, occur through the rock, forming about 1% of it.

Fluorescence Mode (B.27336)

There are a few microspores in the rare shaly lenses.

12. 2817.0 metres 9242 feet LN 43319

Sandstone with carbonaceous streaks.

Fluorescence Mode (B.27337)

No exinite apparent.

13. 2818.5 metres 9247 feet LN 46741

Black mudstone with conchoidal fracture.

Transmitted light (TS 25364)

The dispersed organic matter varies in the different layers of the rock from about 10 to 80%, probably 40% overall. It is virtually all opaque and occurs in fragments 50 to 200 microns in size.

14. 2819.4 metres 9250 feet LN 46743

Black mudstone with conchoidal fracture.

Transmitted light (TS 25365)

The dispersed organic matter is similar to that in the rock above, except that 20% of the fragments are transparent.

15. 2827.0 metres 9275 feet LN 43322

Carbonaceous siltstone/shale.

Transmitted light (TS 24244)

Some areas of the rock consist of about 60% carbonaceous matter, others 30%, the remainder being mostly quartz grains. The coaly matter is predominantly opaque, although transparent around the edges, so may be vitrinite. The overall content of organic matter is about 20%.

16. <u>2842.9 metres</u> <u>9327 feet</u> <u>LN 43326</u>

Black carbonaceous mudstone with conchoidal fracture.

<u>Transmitted light</u> (TS 24245)

Dispersed organic matter is spread evenly through the matrix of the rock as fragments from a few microns to about 200 microns size, forming approximately 30% of the rock. Most of the larger fragments are opaque. The abundant finer material is fragmentary or amorphous, with transparent pieces opaque ones. The rock contains a few well-preserved brown spores.

<u>Fluorescence Mode</u> (B.27339)

No exinite apparent.

17. <u>2864.8 metres</u> <u>9399 feet</u> <u>LN 43327</u>

Sandstone with carbonaceous lenses.

<u>Transmitted light</u> (TS 24246)

The dispersed organic matter is sparse, mostly opaque, with a few transparent fragments (100 microns), and stringers.

<u>Fluorescence Mode</u> (B.27340)

No exinite apparent.

18. <u>2890.4 metres</u> <u>9483 feet</u> <u>LN 43329</u>

Carbonaceous shale, with abundant fossil leaves.

<u>Transmitted light</u> (TS 24247)

The dispersed organic matter occurs as layers of fine fragments (50 microns) and frequent long thin stringers. Most of the material is opaque, and forms about 10% of the rock.

<u>Fluorescence Mode</u> (B.27341)

Extremely rare microspores.

19. <u>2893.5 metres</u> <u>9493 feet</u> <u>LN 43331</u>

Black carbonaceous shale with leaf impressions.

<u>Fluorescence Mode</u> (B.27342)

No exinite apparent.

20. <u>2895.0 metres</u> <u>9498 feet</u> <u>LN 43332</u>

Dark grey carbonaceous shale.

<u>Fluorescence Mode</u> (B.27345)

No exinite apparent.

21. <u>2905.0 metres</u> <u>9531 feet</u> <u>LN 43335</u>

Dark grey shale.

<u>Fluorescence Mode</u> (B.27343)

No exinite apparent.

22. <u>2909.0 metres</u> <u>9544 feet</u> <u>LN 43336</u>

White siltstone with dark carbonaceous streaks.

<u>Transmitted light</u> (TS 24248)

There are abundant stringers of carbonaceous material around and between the clastic grains. Most is opaque and macroscopically visible, about 3% of the rock.

<u>Fluorescence Mode</u> (B.27344)

No exinite apparent.

APPENDIX 3.3

Fly Lake No.3, Cooper Basin

Description of dispersed organic matter in the interseam sediments

1. 2651.5 metres 8699 feet LN 46757

Very fine sandstone with carbonaceous "scares".

Transmitted light (TS 25366)

There is little carbonaceous matter in the bulk of the rock, except for the "scares". The material in these is opaque. The overall percentage of dispersed organic matter varies greatly, but is probably < 2% overall.

Fluorescence Mode (B.27058)

Some small (200-300 microns) shaly lenses contain microspores, 2-3% of the lens, and rare algae. The sandy portions contain no exinitic material, and the shale lenses form only a very small proportion of the rock. Exinitic material is < 1% overall.

2. 2654.2 metres 8708 feet LN 46758

Light and dark laminated siltstone.

Transmitted light (TS 25367)

The dispersed organic matter occurs in small fragments and stringers (15-50 μ in size), very evenly dispersed through the rock along the bedding direction. It comprises probably about 25% of the rock, but is virtually all opaque. Layers of coarser grained material (light coloured; usually about 100 μ wide) have very little organic matter in them.

Fluorescence Mode (B.27059)

Microspores are plentiful in the shaly layers, 2-3%, and there are rare algae, which occur singly, and very rare cuticles. As most of the rock is shaly, with just a few sandy lenses, the exinitic content is probably about 1-2%.

3. <u>2660.4 metres</u> <u>8728.5 feet</u> <u>LN 46762</u>

Grey mudstone with rare plant fossils.

<u>Transmitted light</u> (TS 25368)

The rock contains about 5% of very fine (5-30 μ) carbonaceous fragments, scattered evenly through the rock. They are virtually all opaque.

<u>Fluorescence Mode</u> (B.27060)

Very rare microspores. Exinitic material < 1%.

4. <u>2661.8 metres</u> <u>8733 feet</u> <u>LN 46763</u>

Dark grey fossiliferous carbonaceous shale.

<u>Transmitted light</u> (TS 25369)

The carbonaceous material occurs as either long, thin (10-30 μ) stringers, approximately parallel to the bedding, and in between these very fine fragments (10 μ) scattered evenly through the matrix of the rock. All of this material is opaque, and probably forms 3-4% of the rock.

<u>Fluorescence Mode</u> (B.27061)

There are rare microspores and cuticles. Most of the organic matter seems to be vitrinitic; exinitic material is < 1%.

5. <u>2668.2 metres</u> <u>8754 feet</u> <u>LN 46765</u>

Light and dark laminated siltstone.

<u>Transmitted light</u> (TS 25370)

The dispersed organic matter tends to be concentrated more in the finer grained layers, where it occurs as very fine fragments (10-30 μ) and small stringers. The fragments are a bit coarser in the coarser grained lenses. The dispersed organic matter is about 10% of the rock, and is virtually all opaque.

Fluorescence Mode (B.27062)

There is 1-2% microspores in the fine grained portions of the rock; also rare cuticle and very rare algae. The overall exinitic content is probably about 1%.

6. 2671.1 metres 8763.5 feet LN 46768

Black carbonaceous shale.

Transmitted light (TS 25371)

The organic matter occurs fairly evenly distributed through the rock, as fine fragments and stringers, probably about 30% of the whole. Most of it is opaque, but there are rare transparent fragments, generally about 30μ in size.

Fluorescence Mode (B.27063)

Exinitic material is abundant, predominantly microspores, but also sparse algae and cuticle. Exinite probably forms about 5% of the rock.

7. 2673.1 metres 8770 feet LN 46769

Black carbonaceous mudstone.

Transmitted light (TS 25372)

The dispersed organic matter occurs as fine fragments (20 μ), about 30% of the rock. It is virtually all opaque, except for very rare transparent bodies (about 30 μ) as above. These may be algae.

Fluorescence Mode (B.27064)

Exinitic material is abundant, mostly microspores and sparse algae. There is no exinite in the sandy lenses. Exinite forms about 3-4% of the rock.

8. <u>2674.6 metres</u> <u>8775 feet</u> <u>LN 56770</u>

Black carbonaceous shale.

<u>Transmitted light</u> (TS 25373)

Dispersed organic matter occurs as fine fragments (20-30 μ) and stringers, forming about 40% of the rock. It is virtually all opaque.

<u>Fluorescence Mode</u> (B.27065)

Microspores are plentiful, except in coarse grained lenses, 2-3% of the fine-grained part. Algae are very rare, so are cuticles. The overall content of exinite material is probably about 2%.

9. <u>2677.7 metres</u> <u>8785 feet</u> <u>LN 46772</u>

Black, carbonaceous, fossiliferous shale.

<u>Transmitted light</u> (TS 25374)

Dispersed organic matter forms about 20% of the rock, and occurs mainly as small stringers (10-20 μ wide) and fragments. There are rare coarser pieces 100-200 microns in size. Most of the organic matter is opaque; the transparent fragments appear to be of a vitrinite type.

<u>Fluorescence Mode</u> (B.27066)

Cuticles and microspores are plentiful in some bands of the rock, rare in others. Algae are extremely rare. Exinitic matter is probably about 1% overall.

10. <u>2679.3 metres</u> <u>8790.5 feet</u> <u>LN 46773</u>

Laminated light and dark siltstone.

Transmitted light (TS 25375)

The carbonaceous matter is fairly well restricted to the finer grained bands, of which it forms about 5%. The overall carbonaceous content is probably about 2%. The organic matter occurs as fragments and stringers, generally 100-200 microns in size. Virtually all of the organic matter is opaque.

Fluorescence Mode (B.27067)

There is no exinitic material in the coarse grained portion of the rock, and only very rare microspores in the finer grained lenses. The amount of exinitic material < 1%.

11. 2681.5 metres 8797.5 feet LN 46776

Fossiliferous, laminated light and dark shale.

Transmitted light (TS 25376)

The rock has macroscopically visible "scares" of carbonaceous material wandering through it. These consist of long chains of fragments, generally about 10 μ in size, or else much coarser coherent organic matter. Virtually all of this material is opaque. Nodules of siderite are associated with some of these scares, about 0.5 mm in diameter.

Fluorescence Mode (B.27068)

There are a few microspores in the "scares" which appear to consist mainly of vitrinite and inertinite. Apart from these concentrations there is no exinitic material through the rock. Exinite < 1%.

12. 2684.4 metres 8807 feet LN 46781

Dark grey siltstone.

Transmitted light (TS 25377)

Carbonaceous matter forms about 20% of the rock, as stringers and fragments interlaced between the inorganic detrital grains. The average size of the material is about 100 microns and it is virtually all opaque.

Fluorescence Mode (B.27069)

There are rare microspores scattered through the rock: exinite < 1%.

13. 2800.5 metres 9188 feet LN 46782

Pale sandstone with abundant carbonaceous streaks.

Transmitted light (TS 25378)

The organic matter occurs in macroscopically visible stringers mostly, with a few finer scattered fragments, forming about 3% of the rock. The organic material is all opaque.

Fluorescence Mode (B.27070)

There are a few very rare microspores in the coaly layers: exinite < 1%.

14. 2804.0 metres 9199.5 feet LN 46783

Carbonaceous siltstone.

Transmitted light (TS 25379)

The organic matter occurs both as macroscopic and microscopic stringers, and as fragments from about 10 to 100 microns. The fragments are mostly concentrated into layers, with only rare pieces scattered through the whole rock. The organic matter is virtually all opaque, although some thinner parts of the larger streaks are slightly transparent, suggesting they may be of a vitrinitic nature.

Fluorescence Mode (B.27071)

There are a few microspores in the fine-grained lenses, which are rare. Exinite content < 1%.

15. 2807.1 metres 9209.5 feet LN 46787

Carbonaceous shale.

Transmitted light (TS 25380)

The organic matter occurs as fine fragments (20-100 microns) and stringers, scattered fairly evenly through the rock, except for occasional layers, some hundreds of microns thick, which contain no organic material at all. The organic matter forms about 2-3% of the rock, and is opaque. Rare larger fragments occur.

Fluorescence Mode (B.27072)

Rare microspores and cuticles occur in the fine-grained portions of the rock. Exinite < 1%.

16. 2809.0 metres 9216 feet LN 46788

Dark grey siltstone.

Transmitted light (TS 25381)

Organic matter forms about 10% of the rock, and occurs as fragments, generally 10-15 microns scattered evenly through the rock. These fragments are opaque.

Fluorescence Mode (B.27073)

No exinitic material visible.

17. 2810.9 metres 9222 feet LN 46789

Dark grey carbonaceous shale.

Transmitted light (TS 25382)

The organic matter occurs as stringers, generally 20-200 microns long, and fine fragments 10-50 microns in size. The material is scattered evenly through the rock and forms about 10% of it. Much of the dispersed material is opaque but there are also transparent stringers and fragments. This transparent matter is probably of a vitrinite type.

Fluorescence Mode (B.27074)

There are very rare microspores. Exinite < 1%.

18. 2837.7 metres 9310 feet LN 46790

Dark grey siltstone.

Transmitted light (TS 25383)

Carbonaceous material forms about 30% of the rock and occurs as stringers interwoven between the inorganic detrital grains; also as fragments about 50 microns in size. Almost all of this material is opaque, rare transparent stringers being of a vitrinite type.

Fluorescence Mode (B.27075)

There are extremely rare microspores. Exinite < 1%.

19. 2840.1 metres 9318 feet LN 46791

Black mudstone with silty lenses.

Transmitted light (TS 25384)

The fine-grained part of the rock contains about 5% organic matter which occurs as very fine fragments 5-10 microns in size, most of which are opaque. The coarser silty lenses contain about 10% organic matter which is also in coarser fragments 50-100 microns, and is both transparent and opaque. However, the transparent material appears to be of a vitrinite type.

Fluorescence Mode (B.27127)

No exinite apparent.

20. 2842.0 metres 9324 feet LN 46793

Grey sandstone with carbonaceous blebs.

Transmitted light (TS 25385)

The carbonaceous matter is fairly coarse in fragments and stringers 100-500 microns, forming about 2% of the rock. The organic matter is opaque.

Fluorescence Mode (B.27128)

No exinite apparent.

21. 2843.8 metres 9330 feet LN 46794

Grey silty mudstone.

Transmitted light (TS 25386)

Carbonaceous matter forms about 15% of the rock; it occurs as fragments (5-50 microns) and stringers and is opaque.

Fluorescence Mode (B.27129)

No exinite apparent.

22. 2945.3 metres 9335 feet LN 46795

Black carbonaceous shale.

Transmitted light (TS 25387)

About 40% of the rock is carbonaceous material, mostly thin bands up to 30 μ wide. The thinnest bands ($< 5\mu$) are both opaque and transparent, but the thicker bands are transparent and appear to be of a vitrinite type. This is the first rock examined from the top of the Patchawarra Formation down, which has contained predominantly transparent organic matter.

Fluorescence Mode (B.27130)

Microspores, and more rarely cuticle and algae, occur sparsely through the rock probably about 1% of it.

23. <u>2847.0 metres</u> <u>9340.5 feet</u> <u>LN 46796</u>

Grey shale.

<u>Transmitted light</u> (TS 25388)

About 20% of the rock consists of fragments, 10-50 microns, scattered evenly throughout. Most of these fragments are opaque, but some are transparent of a vitrinite type. Occasional long stringers through the rock are transparent.

<u>Fluorescence Mode</u> (B.27131)

No exinite apparent.

24. <u>2849.9 metres</u> <u>9350 feet</u> <u>LN 46799</u>

Dark grey carbonaceous siltstone.

<u>Transmitted light</u> (TS 25389)

Organic matter forms about 20% of the rock. It occurs as stringers and fragments generally 20-50 microns in size. Virtually all of this material is opaque.

<u>Fluorescence Mode</u> (B.27132)

No exinite apparent.

25. <u>2854.8 metres</u> <u>9366 feet</u> <u>LN 46800</u>

Black carbonaceous shale.

<u>Transmitted light</u> (TS 25390)

About 20% of the rock is organic matter, from extremely fine fragments, 5 microns, to macroscopically visible bands. The coarser material is opaque, but much of the fine stringers and fragments is transparent. The transparent material appears to be of a vitrinite type.

Fluorescence Mode (B.27133)

No exinite apparent.

26. 2855.1 metres 9367 feet LN 46801

Siltstone.

Transmitted light (TS 25391)

Organic matter forms about 2% of the rock, and occurs as fragments generally 30-100 microns in size. These are opaque.

Fluorescence Mode (B.27134)

No exinite apparent.

27. 2858.1 metres 9377 feet LN 46803

Grey carbonaceous silty mudstone with brown pellets. (The pellets seem to be of clay).

Transmitted light (TS 25392)

The organic matter occurs as very fine fragments (5-30 microns), scattered evenly through the rock and forming about 2% of it. Most of the fragments are opaque; the transparent fragments seem to be of a vitrinite type.

Fluorescence Mode (B.27135)

No exinite apparent.

28. 2876.4 metres 9437 feet LN 46807

Grey silty mudstone with carbonaceous fragments.

Transmitted light (TS 25393)

Organic matter occurs as fine fragments, (5-50 microns), and a few stringers spread evenly through the rock forming about 10% of it. Virtually all of the fragments are opaque.

Fluorescence Mode (B.27136)

No exinite apparent.

29. <u>2877.9 metres</u> <u>9442 feet</u> <u>LN 46809</u>

Black micaceous mudstone.

<u>Transmitted light</u> (TS 25394)

Organic matter forms about 25% of the rock occurring mostly as short stringers (100-200 microns) and some fragments (10-15 microns). Most of the material is opaque, but some of the fragments and stringers are transparent.

<u>Fluorescence Mode</u> (B.27137)

No exinite apparent.

30. <u>2879.4 metres</u> <u>9447 feet</u> <u>LN 46810</u>

Carbonaceous shale.

<u>Transmitted light</u> (TS 25395)

Most of the rock contains only very fine fragments (5-20 microns) and a few stringers of organic matter; 1 to 2%. Certain layers contain 5-10% organic matter in the form of long stringers, which appear to be mostly opaque, but do have a form similar to cuticles.

<u>Fluorescence Mode</u> (B.27138)

No exinite apparent.

31. <u>2879.8 metres</u> <u>9448 feet</u> <u>LN 46811</u>

Carbonaceous shale.

<u>Transmitted light</u> (TS 25396)

Organic matter forms about 20% of the rock, occurring generally as very fine fragments (5-20 microns). Some coarse streaks are present. A lot of the fragments appear to be opaque, but extremely fine ones may be transparent, and some of the coarse streaks are transparent.

<u>Fluorescence Mode</u> (B.27139)

No exinite apparent, but there are many fragments 10-20 microns which fluoresce yellow. These may be minerals or disintegrated pieces of exinite.

32. <u>2811.0 metres</u> <u>9452 feet</u> <u>LN 46812</u>

Black mudstone.

<u>Transmitted light</u> (TS 25397)

Organic matter forms about 30% of the rock and occurs as fragments from a few microns to about 100 microns, in general. Most fragments are opaque: very rare transparent ones may be algae.

<u>Fluorescence Mode</u> (B.27140)

Possibly very rare microspores.

33. <u>2882.6 metres</u> <u>9457.5 feet</u> <u>LN 46813</u>

Grey laminated silstone.

<u>Transmitted light</u> (TS 25398)

Carbonaceous matter forms about 20% of the rock, as short stringers. Most of the material appears to be opaque, but there are some transparent fragments.

<u>Fluorescence Mode</u> (B 27141)

No exinite apparent

34. <u>2885.2 metres</u> <u>9466 feet</u> <u>LN 46814</u>

Black carbonaceous shale.

<u>Transmitted light</u> (TS 25399)

The organic matter occurs in fine fragments to macroscopically visible bands, forming about 25% of the rock. Most of the coarser material, and even the fragments, are opaque. There is however some transparent material, possibly spores.

<u>Fluorescence Mode</u> (B 27142)

There is some very faintly fluorescent yellow-brown material which may be microspores. Also there are yellowish fragments which may be a mineral or disintegrated exinite (cf LN 46811)

35. 2890.1 metres 9482 feet LN 46816

Grey micacious siltstone.

Transmitted light (TS 25400)

Organic matter forms about 10% of the rock occurring mostly as stringers up to hundreds of microns long and some fragments up to about 100 . Most of the material is opaque, but there are rare transparent fragments.

Fluorescence Mode (B.27143)

No exinite apparent.

36. 2892.2 metres 9489 feet LN 46817

Laminated light and dark micacious, carbonaceous siltstone.

Transmitted light (TS 25401)

The lighter areas contain 5-10% organic matter as fragments up to about 100 microns, which are both opaque and transparent. The darker areas contain about 20% organic matter, as stringers and coarser fragments, mostly opaque, but some fragments are transparent.

Fluorescence Mode (B.27144)

There are possibly a few microspores in the finger-grained portions of the rock, but the fluorescence of the material is very faint.

37. 2895.0 metres 9498 feet LN 46818

Pale grey sandstone.

Transmitted light (TS 25402)

Contains virtually no organic matter.

Fluorescence Mode (B.27223)

No exinite apparent.

38. 2897.3 metres 9505.5 feet LN 46819

Dark grey mudstone.

Transmitted light (TS 25403)

This rock contains about 10% of very fine fragments (5-50 microns) of dispersed organic matter, with a few fine stringers. Most of this organic matter is opaque.

<u>Fluorescence Mode</u> (B.27224)

No exinite apparent.

39. <u>2899.1 metres</u> <u>9511.5 feet</u> <u>LN 46823</u>

Black carbonaceous shale.

<u>Transmitted light</u> (TS 25404)

Organic matter occurs as extremely fine fragments to ones 100-200 microns, to macroscopically visible bands. The average size is about 30-50 microns. Carbonaceous matter probably forms about 20% of the rock, but it is difficult to judge because of the fineness of many particles. Most of the fragments seem opaque, but there are some fine transparent ones, possibly spores.

<u>Fluorescence Mode</u> (B.27225)

Cuticles and microspores are fairly abundant in one thin (5mm) band of the rock, but absent from the rest of it. Overall exinite is probably 1%.

40. <u>2900.5 metres</u> <u>9516 feet</u> <u>LN 46824</u>

Dark grey mudstone.

<u>Transmitted light</u> (TS 25405)

Carbonaceous fragments, generally about 30 microns in size, form approximately 25% of the rock. These fragments are nearly all opaque, although there are a few transparent ones.

<u>Fluorescence Mode</u> (B.27226)

No exinite apparent.

41. <u>2902.0 metres</u> <u>9521 feet</u> <u>LN 46826</u>

Black carbonaceous shale.

Transmitted light (TS 25406)

Carbonaceous material occurs generally as very fine fragments, 5-10 microns, but up to 50 microns, and also as long thin stringers. The proportion in the rock is probably 5-10%. Most of the material is opaque: some of the stringers are transparent, but appear to be of a vitrinite type.

Fluorescence Mode (B.27227)

No exinite apparent.

42. 2902.9 metres 9524 feet LN 46827

Black carbonaceous shale.

Transmitted light (TS 25407)

Carbonaceous matter is about 35% overall, occurring as coarse bands in some layers, and coarse fragments up to 100 microns, and as very fine stringers in others. Most of the material is opaque, but sparse transparent megaspores are quite obvious. There are also thin transparent bands, and microspores, possibly even algae, although the smaller bodies are harder to delineate. Some of the more persistent bands may be vitrinitic.

Fluorescence Mode (B.27228)

There are microspores and cuticles in one half of the sample, probably forming 2-3%, and some rare megaspores. The overall exinite content is possibly 1%.

43. 2906.3 metres 9535 feet LN 46833

Dark grey carbonaceous mudstone.

Transmitted light (TS 25408)

Organic matter is dispersed evenly through the rock as fine fragments and stringers, with occasionally macroscopically visible stringers. It forms about 15% of the rock, and is mostly opaque, although there are a few transparent fragments.

Fluorescence Mode (B.27229)

Extremely rare microspores are present.

44. 2906.9 metres 9537 feet LN 46834

Shaly coal.

Transmitted light (TS 25409)

This rock is very rich in carbonaceous matter almost a coal, probably about 70%, most of which is transparent with opaque fragments, up to about 100 microns.

Fluorescence Mode (B.27230)

Sparse microspores.

45. 2908.1 metres 9541 feet LN 46835

Dark grey carbonaceous shale.

Transmitted light (TS 25410)

The organic matter occurs in fairly coarse fragments (5-100 microns) and stringers dispersed evenly through the rock and forming about 35% of it. Many of the fragments are opaque, but transparent fragments and stringers are also fairly abundant. It is difficult to determine the botanical source of the transparent material.

Fluorescence Mode (B.27231)

No exinite apparent.

46. 2908.4 metres 9542 feet LN 46836

Dark grey siltstone.

Transmitted light (TS 25411)

Carbonaceous matter occurs interwound between the inorganic detrital grains, fairly coarse and forming about 25% of the rock. It is all opaque.

Fluorescence Mode (B.27232)

No exinite apparent.

47. 2909.9 metres 9547 feet LN 46841

Dark grey shale.

Transmitted light (TS 25412)

Organic matter occurs in fairly fine fragments (20-30 microns) and stringers, forming about 20% of the rock. Most of the material is opaque, but there are rare transparent bodies, which may be algae, and some of the wider stringers show transparent patches - probably vitrinite.

Fluorescence Mode (B.27233)

No exinite apparent.

48. 2911.8 metres 9553 feet LN 46842

Grey siltstone.

Transmitted light (TS 25413)

The organic matter occurs in irregular patches of fragments which are from a few microns in size to 200 microns. Organic matter is probably 2-3% of the rock and is all opaque.

Fluorescence Mode (B.27234)

No exinite apparent.

49. 2915.3 metres 9564.5 feet LN 46843

Pale sandstone.

Transmitted light (TS 25414)

Organic matter forms 2-3% of the rock, between detrital grains as clusters of fine fragments. All are opaque.

Fluorescence Mode (B.27235)

No exinite apparent.

50. 2918.8 metres   9576 feet   LN 46844

Black coaly shale.

Transmitted light (TS 25415)

Parts of the rock are coal, and are opaque; others have about 20% organic matter, mostly transparent, whilst some areas contain only 2-3% fine opaque fragments. Overall the content is about 15%. The transparent material seems to be of a vitrinite type.

Fluorescence Mode (B.27236)

No exinite apparent.

51. 2919.7 metres   9579 feet   LN 36847

Coaly black carbonaceous shale.

Transmitted light (TS 25416)

The rock consists of about 50% organic matter, mostly as long stringers. The organic matter appears to be all opaque, but its abundance may mask any transparent occurrences.

Fluorescence Mode (B.27237)

Very rare cuticles and microspores present.

52. 2922.1 metres   9587 feet   LN 46849

Pale sandstone with carbonaceous patches.

Transmitted light (TS 25417)

The carbonaceous matter occurs as fine fragments amongst the inorganic detrital grains. It forms about 5% of the rock and is opaque.

Fluorescence Mode (B.27238)

No exinite apparent.

APPENDIX 3.4

Brolga No.1 Well, Cooper Basin

Descriptions of dispersed organic matter in the interseam sediments

1. 2722.8 metres 8933 feet LN 47150

Black carbonaceous shale.

Transmitted light (TS 25508)

Approximately 40% of the rock is carbonaceous material, of which half is transparent, half opaque. Both the transparent and opaque material occur as fragments from a few microns to tens of microns in size. The transparent material is botanically, predominantly of a vitrinite-type rather than exinite type.

Fluorescence Mode (B.27145)

Microspores are scattered fairly evenly all through the rock, forming about 1% of it. Occurrences of algae and cuticle are very rare.

2. 2726.0 metres 8943.5 feet LN 47152

Grey carbonaceous shale with abundant fossil plant fragments.

Transmitted light (TS 25509)

This rock contains about 10% carbonaceous material, the coarse fraction of which occurs more as thin streaks rather than fragments. There are abundant small fragments of a few microns size scattered uniformly through the groundmass. Most of the fine material is opaque; the coarser streaks and fragments are half transparent, half opaque.

Fluorescence Mode (B.27146)

Microspores are scattered sparsely through the rock, forming < 1% of it. Cuticle is very rare.

3. 2728.0 metres 8950 feet LN 47153

Very fine-grained sandstone with carbonaceous laminations.

Transmitted light (TS 25569)

The rock contains < 1% carbonaceous matter, which occurs mostly as elongated opaque fragments, a few millimetres in size.

Fluorescence Mode (B.27147)

Microspores and algae are plentiful in the finer grained lenses, but these form only a small part of the rock. The algae are of various sizes, from about 15 to 100 microns size. The overall exinite content of the rock is very low.

4. 2730.1 metres 8957 feet LN 47154

Carbonaceous siltstone.

Transmitted light (TS 25570)

This rock contains about 10% dispersed organic matter, which occurs as fragments, generally showing orientation parallel to the bedding. The fragments are predominantly opaque with rare transparent pieces. The fragments are from a few microns, to tens of microns, 10-20 micron size being most common.

Fluorescence Mode (B.27148)

Microspores occur sparsely through most of the rock, a little more abundantly in the finer grained lenses. There are rare occurrences of cuticle and sparse algae. Most algae are fairly large, about 100 microns in size. The overall exinite content is < 1% of the rock.

5. 2734.1 metres 8970 feet LN 47155

Carbonaceous siltstone.

Transmitted light (TS 25571)

Approximately 40% of the rock is dispersed organic matter, most of which is opaque fragments, 10-20 microns in size. There are rare transparent fragments and spores.

Fluorescence Mode (B.27149)

Microspores are scattered through the rock, about 1% of the total volume. There are rare small algae, 10-50 microns in size.

6. 2734.4 metres 8971 feet LN 50019

Carbonaceous sandstone/siltstone.

Transmitted light (TS 26612)

Dispersed organic matter forms about 5% of the rock, occurring mainly as stringers, and lenses, up to macroscopically visible size. Some of these stringers show transparent sections, of a vitrinite-type.

Fluorescence Mode (B.26904)

Cuticles and microspores are very rare: most of the organic matter appears dark brown (vitrinite) or red (inertinite). Exinite < 1%.

7. 2734.7 metres 8972 feet LN 50020

Carbonaceous siltstone/sandstone.

Transmitted light (TS 26613)

Organic matter forms 5-10% of the rock, mostly occurring as stringers in between the inorganic grains, and as fragments from a few microns to 200 microns in size. Most of the material is opaque, but a few stringers are transparent.

Fluorescence Mode (B.26905)

Microspores are extremely rare. Exinite << 1%.

8. 2735.0 metres 8973 feet LN 50021

Carbonaceous shale with silty lenses.

Transmitted light (TS 26614)

The organic matter occurs in layers, where it forms 50% of some (about ⅓ of the rock) and 1-2% of others (about 2/3 of the rock). Transparent and opaque matter (fragments) occur in about equal proportions. The transparent matter appears to be microspores and rare algae.

Fluorescence Mode (B.26906)

Microspores are abundant in some layers, forming about 5% of these lenses. These are the finer bands of the rock and constitute about half of it. The microspores therefore form about 2-3% of the whole rock, and are generally only faintly fluorescent. There are very rare algae.

9. 2735.3 metres 8974 feet LN 50022

Black carbonaceous shale with pale silty lenses.

Transmitted light (TS 26615)

The organic matter occurs in irregularly shaped, macroscopically visible patches. These are composed of fragments, sometimes up to 80% by volume of the rock. Some organic areas are composed of extremely fine fragments all 5 microns; in others the fragments are 50-200 microns. Much of the organic matter is transparent, but is of fragmental shape, so is probably vitrinitic. It is difficult to detect spore or algal shapes in the mass of organic debris. In the areas of little organic matter the fragments are mostly opaque. The overall dispersed organic matter content is about 40%.

Fluorescence Mode (B.26907)

Microspores are scattered fairly evenly through most of the rock, except in the coarser grained lenses. They are weakly fluorescent, and form about 2-3% of the rock. There are very rare algae which are not usually associated with the spores, but occur in the coarser parts of the rock, and most often singly. Cuticles are very rare.

10. 2735.4 metres 8974.5 feet LN 50023

Black carbonaceous shale with some silty lenses.

Transmitted light (TS 26616)

The dispersed organic matter occurs in lenses only, hundreds of microns thick, and some of the rock contains virtually no organic material at all. Elsewhere it forms 60-70% of the area. Most of the dispersed organic matter is transparent, but is fragmental, probably vitrinite-type.

Fluorescence Mode (B.26908)

Microspores are abundant; algae are sparse and of different sizes (20-100 microns), occurring singly for the most part. Microspores form 4-5% of the rock.

11. 2735.6 metres 8975 feet LN 47156

Black carbonaceous shale.

Transmitted light (TS 25510)

About 30% of the rock is dispersed organic matter, 60% transparent, 40% opaque. The transparent material occurs as fragments and as round or oval algae. The algae have an average size of about 100 microns. The fragments average 50 to 100 microns in size.

Fluorescence Mode (B.27150)

Algae are abundant throughout the rock, and are of various sizes from about 10 to 200 microns. Microspores are plentiful in lenses through the rock, cuticles are rare. The overall exinite content is about 5-10%.

12. 2736.2 metres 8977 feet LN 50025

Grey carbonaceous siltstone.

Transmitted light (TS 26618)

Dispersed organic matter forms about 15% of the rock, mostly as fine stringers, although some of them are centimetres long. Most of the organic matter is opaque, although there are some transparent spores.

Fluorescence Mode (B.26909)

There are very rare microspores and algae. Exinite content $\ll$ 1%.

13. 2736.5 metres 8978 feet LN 50026

Carbonaceous siltstone.

Transmitted light (TS 26619)

About 40% of the rock is carbonaceous matter, as fragments up to 200 microns, both transparent and opaque.

Fluorescence Mode (B.26910)

Microspores and algae are rare, except for a few lenses where microspores form 2-3%. Exinitic material is 1% of the rock.

14. 2737.0 metres 8979.5 feet LN 47157

Siltstone with coaly lenses.

Transmitted light (TS 25572)

The rock contains many macroscopically visible streaks of carbonaceous material, which is opaque. Between these bands are much thinner streaks and small fragments of organic material (50-100 microns), probably 10-15% of the rock, much of which is also opaque. The transparent material is fragmentary.

Fluorescence Mode (B.27151)

Microspores and cuticles occur abundantly in the carbonaceous lenses of the rock. Elsewhere only microspores occur rarely. The overall exinite content is 1%.

15. 2738.8 metres 8985.5 feet LN 47158

Laminated carbonaceous siltstone.

Transmitted light (TS 25573)

This rock contains about 5% dispersed organic matter which occurs as streaks and fragments, most of which are opaque. The fragments are approximately 100 microns in size.

Fluorescence Mode (B.27152)

There are sparse cuticles and microspores, usually confined to the carbonaceous lenses.

16. 2820.3 metres 9253 feet LN 47165

Carbonaceous shale.

Transmitted light (TS 25511)

Dispersed organic matter makes up about 10% of this rock, occurring as either small fragments 10-20 microns, or macroscopically visible streaks. The coarse material is generally opaque. The fine fragments are 90% opaque, 10% transparent.

Fluorescence Mode (B.27153)

Extremely rare microspores and megaspores.

17. 2823.4 metres 9263 feet LN 47167

Dark grey carbonaceous siltstone.

Transmitted light (TS 25574)

10% of the rock is dispersed organic matter, in fragments from a few microns in size to macroscopically visible streaks. Most fragments are 50-200 microns and are virtually all opaque.

Fluorescence Mode (B.27154)

No exinite apparent.

18. 2825.5 metres 9270 feet LN 47169

Sandstone with carbonaceous streaks.

Transmitted light (TS 25575)

This rock contains about 1% dispersed organic matter, most of which occurs in macroscopically visible streaks, which are opaque.

Fluorescence Mode (B.27155)

Extremely rare microspores are associated with the carbonaceous streaks.

19. 2833.4 metres 9296 feet LN 47180

Fine-grained micaceous sandstone.

Transmitted light (TS 25576)

The rock contains 2-3% dispersed organic matter which occurs in fragments from about 50-200 microns in size. These fragments are virtually all opaque.

Fluorescence Mode (B.27156)

No exinite apparent.

20. 2840.1 metres 9318 feet LN 47181

Sandstone.

Transmitted light (TS 25512)

This rock contains less than 1% dispersed organic matter, which occurs as small opaque fragments of about 10 microns size.

<u>Fluorescence Mode</u> (B.27157)

No exinite apparent.

21. <u>2845.0 metres</u> <u>9334 feet</u> <u>LN 47184</u>

Dark grey carbonaceous siltstone.

<u>Transmitted light</u> (TS 25577)

Dispersed organic matter forms about 10% of the rock, and occurs as fragments of 20 to 100 microns average size. The fragments are predominantly opaque. Transparent fragments are of a vitrinite-type.

<u>Fluorescence Mode</u> (B.27158)

No exinite apparent.

22. <u>2845.6 metres</u> <u>9336 feet</u> <u>LN 47185</u>

Black carbonaceous shale.

<u>Transmitted light</u> (TS 25513)

About 30% of the rock is dispersed organic matter, occurring mostly as fragments 20 to 100 microns in size. The proportions of opaque and transparent material are approximately equal.

<u>Fluorescence Mode</u> (B.27159)

No exinite apparent.

23. <u>2848.7 metres</u> <u>9346 feet</u> <u>LN 47186</u>

Black carbonaceous shale.

<u>Transmitted light</u> (TS 25578)

This rock contains about 5% dispersed organic matter, which occurs as small fragments and stringers, generally 10-15 microns in size. Most of the material is opaque.

<u>Fluorescence Mode</u> (B.27160)

No exinite apparent.

24. <u>2852.2 metres</u> <u>9357.5 feet</u> <u>LN 47188</u>

Grey carbonaceous siltstone.

<u>Transmitted light</u> (TS 25580)

Carbonaceous matter forms 5% of the rock. It occurs as fragments from about 20 to 100 microns in size, which are virtually all opaque.

<u>Fluorescence Mode</u> (B.27175)

No exinite apparent.

25. <u>2903.2 metres</u> <u>9525 feet</u> <u>LN 47189</u>

Dark grey carbonaceous silty shale.

<u>Transmitted light</u> (TS 25581)

The rock contains about 10% dispersed organic matter, which occurs as fragments generally 10 to 50 microns in size. Virtually all fragments are opaque.

<u>Fluorescence Mode</u> (B.27161)

No exinite apparent.

26. <u>2906.9 metres</u> <u>9537 feet</u> <u>LN 47190</u>

Sandstone with carbonaceous patches.

<u>Transmitted light</u> (TS 25514)

No organic matter apparent in thin section.

<u>Fluorescence Mode</u> (B.27176)

No exinite apparent.

27. <u>2911.5 metres</u> <u>9552 feet</u> <u>LN 47191</u>

Grey siltstone.

<u>Transmitted light</u> (TS 25582)

This rock contains 5-10% dispersed organic matter, which occurs as fragments generally 5 to 100 microns in size. The fragments are both opaque and transparent.

Fluorescence Mode (B.27162)

No exinite apparent.

28. 2915.0 metres 9563.5 feet LN 47192

Siderite band.

Transmitted light (TS 25583)

This sideritic band contains approximately 15% dispersed organic matter which occurs squeezed between the siderite nodules. It is mostly opaque, but some of it is slightly transparent.

Fluorescence Mode (B.27163)

Rare microspores occur in shaly lenses between nodules.

29. 2917.5 metres 9572 feet LN 47193

Fossiliferous black shale.

Transmitted light (TS 25515)

Carbonaceous matter is about 10% of the rock. It occurs predominantly as very fine fragments (5 to 20 microns) dispersed through the groundmass. Larger fragments up to several hundred microns are irregularly distributed through the rock. Fragments are both opaque and transparent. The transparent material is mostly vitrinite with rare spores.

Fluorescence Mode (B.27164)

No exinite apparent.

30. 2923.3 metres 9591 feet LN 47195

Fine-grained sandstone.

Transmitted light (TS 25584)

The rock contains 1-2% dispersed organic matter, in fragments 20 to 100 microns, virtually all opaque.

Fluorescence Mode (B.27165)

No exinite apparent.

31. 2923.9 metres 9593 feet LN 47196

Interbanded coal and carbonaceous shale.

Transmitted light (TS 25585)

There is about 15% carbonaceous matter in the shale and it occurs as very fine fragments, generally 10-20 microns also stringers up to several hundred microns long occur or may appear as macroscopically visible streaks. The fine fragments and coarse streaks are virtually all opaque, but some of the stringers are transparent.

Fluorescence Mode (B.27166)

Rare microspores in the coaly bands: very rare cuticles.

32. 2925.2 metres 9597 feet LN 47197

Dark grey shale.

Transmitted light (TS 25586)

The rock contains about 10% dispersed organic matter, which occurs as fragments and stringers, generally 50 to 100 microns in size. The organic matter is virtually all opaque.

Fluorescence Mode (B.27167)

No exinite apparent.

33. 2926.1 metres 9600 feet LN 47199

Carbonaceous siltstone.

Transmitted light (TS 25587)

The rock contains 5-10% organic matter which occurs in macroscopically visible streaks millimetres long and as fragments generally about 50 microns in size. The organic material is mostly opaque.

<u>Fluorescence Mode</u> (B.27168)

No exinite apparent.

34. <u>2927.9 metres</u> <u>9606 feet</u> <u>LN 47201</u>

Laminated carbonaceous shale and siltstone.

<u>Transmitted light</u> (TS 25588)

The pale silty layers contain about 5% carbonaceous material as small fragments, 20 to 50 microns in size, and are virtually all opaque. The darker layers contain about 20% of dispersed organic matter, also as fine fragments, as well as stringers 100 to 200 microns long. This material is mostly opaque.

<u>Fluorescence Mode</u> (B.27169)

No exinite apparent.

35. <u>2933.2 metres</u> <u>9623.5 feet</u> <u>LN 47203</u>

Dark grey shale.

<u>Transmitted light</u> (TS 25589)

There is 2-3% dispersed organic matter, occurring as fragments 20 to 100 microns in size, and also rarely as stringers, some hundreds of microns long. Virtually all of the organic material is opaque.

<u>Fluorescence Mode</u> (B.27170)

No exinite apparent.

36. <u>2935.2 metres</u> <u>9630 feet</u> <u>LN 47204</u>

Carbonaceous lithic sandstone.

<u>Transmitted light</u> (TS 25590

This sample shows the junction between coal and sandstone. The contact is very sharp and the coal adjacent to the sandstone is vitrinite. The sandstone is lithic in that it has what appears to be grains of shaly coal (200 microns in size) as well as quartz and other rock fragments in it. There is also carbonaceous matter wrapped around the quartz grains. Overall there is about 5% of this coaly material in the rock, most of it opaque, or semi-opaque.

Fluorescence Mode (B.27171)

No exinite in sandstone.

37. 2944.4 metres 9660 feet LN 47205

Coarse grained lithic sandstone.

Transmitted light (TS 25516)

Contains virtually no carbonaceous material.

Fluorescence Mode (B.27172)

No exinite apparent.

38. 2951.1 metres 9682 feet LN 47206

Grey mudstone with conchoidal fracture.

Transmitted light (TS 25591)

The rock contains $<1\%$ dispersed organic matter, which occurs as opaque fragments 10 to 20 microns in size.

Fluorescence Mode (B.27173)

There are microspores and cuticles associated with coaly bands, and also rare megaspores. No coaly bands were observed in the above thin section.

DEFINITION.

PATCHAWARRA FORMATION : MALABINE COAL MEMBER

Derivation: Australian aboriginal place name meaning salt or brackish water.

Previous usage: New name

Type section: Fly Lake No. 1 Well, Delhi International Oil Corporation from 2729.6 metres to 2745 metres.

(i) Location: 27°38' 13" S
139°56' 48" E approx.
Innamincka Sheet, South Australia

(ii) Repository: South Australian Department of Mines Core Library.

Lithology: Coal

Thickness: Type section 15.4 metres.

Distribution: In the vicinity of the Fly Lake - Brolga trend of the Patchawarra Trough. Seam in the Patchawarra Formation underlain and overlain by fine-grained sandstone.

APPENDIX 5

(from Smyth and Cameron, 1981)

TESTING OF PETROGRAPHIC ANALYSES FOR CORRELATION BETWEEN COALS AND DISPERSED ORGANIC MATTER

When testing for association between the proportions of vitrinite (V), exinite (E) and inertinite (I) in coal, there is a strong negative correlation between vitrinite and inertinite if the exinite content is small because the sum of the components is one. To test for association and overcome the problem of spurious correlations, the usual procedure is to perform some test for dependence between V and I/(1-V) and between I and V/(1-I). If there is no evidence of dependence in either case, then it is said that there is no association between V and I. (The tests for dependence also may equivalently be between V and I/E and between I and V/E.) Darroch and Ratcliff (1978) describe the problem in detail and give references to earlier work.

Spurious correlations can also arise when testing for dependences between two sets of variables, if the sum of the variables in each set is constrained to be one. In the present case we seek dependences between (V_C, E_C, I_C) and (V_D, E_D, I_D) where the subscripts C and D refer to coal and dispersed organic matter respectively. Here, for example, a correlation between V_C and V_D, together with a strong (negative) correlation between V_D and I_D induced by the constraint $V_D + E_D + I_D = 1$ may induce a spurious correlation between V_C and I_D or possibl mask a true one. To overcome this potential bias, the correlations considered should be V_C and I_D/E_D and between I_D and V_C/E_C.

To measure correlation in this study we have chosen to use Kendall's τ because the data can have highly skewed distributions and several zero values, making the usual product moment correlation coefficient inappropriate. Kendall's τ is defined in the Appendix, where we also describe some of its properties. For sample sizes greater than 10, under the hypothesis of no dependence, the distribution of Kendall's τ is approximately normal with mean zero and standard deviation depending on the sample size and the number of tied values (see e.g., Daniel, 1978, p.311). In the following discussion this approximation is always good and we simply quote values of τ and its standard deviation.

Because Kendall's τ measures monotonic and not just linear dependence, a significant τ may represent a curvilinear rather than linear relationship. Sometimes the relationship may be made linear, or nearly so, by taking the reciprocal of one of the variables. This does not alter the value of τ but may substantially alter the value of the product moment correlation. Thus τ may be used to investigate simultaneously a number of possible relations between the variables, but at the cost of some additional effort (e.g., a few plots of the data) being required to interpret fully significant values of τ

As a measure of dependence between two variables X and Y, we have used Kendall's τ rather than the more usual product moment correlation coefficient. In this Appendix we define Kendall's τ, describe how it is estimated and mention some of its properties and some of the benefits in using τ rather than another measure of dependence.

Loosely speaking, Kendall's τ is the difference between the probability that high values of X are associated with high values of Y and the probability that high values of X are associated with low values of Y. More formally, if (X_1, Y_1) and (X_2, Y_2) are two independent observations of the pair of variables (X, Y) then:

$$= \mathrm{Prob}[(X_1-X_2)(Y_1-Y_2)>0]-\mathrm{Prob}[(X_1-X_2)(Y_1-Y_2)<0]$$

Of course, when the distributions of X and Y are not known, this probability cannot be calculated and so it must be estimated from sampled data. Suppose we observe N pairs of values (X_j, Y_j). Let ${}_{jk}$ = sign (X_j-X_k) and ν_{jk} = sign (Y_j-Y_k) for any pair (j,k). Then:

$$\tau = 2\Sigma\nu_{jk}\nu_{jk}/[N(N-1)]$$

where the summation is over all N(N-1)/2 possible pairs (j,k). (A simpler procedure for calculation is given by Daniel, 1978).

The usual product moment correlation coefficient and τ have many properties in common. Thus $-1 \leqslant \tau \leqslant 1$, and if X and Y have a strong linear relationship then τ is close to 1 or -1 according to whether the relationship is positive or negative. However, because τ does not depend on the magnitudes of the observations but only on their relative orders within the samples, τ will be close to 1 if the large values of Y correspond to large values of X not only if the relationship is linear but also if it is curvilinear, provided that it is monotonic. Another advantage of τ, which arises because it is based on orders rather than magnitudes is that outlying observations have a relatively small effect on the estimate, whereas it is well known that one "spurious" observation can greatly affect the value and apparent significance of the product moment correlation coefficient. An additional benefit that is relevant in the present case, where we are dealing with ratios, is that, for example:

$$\tau(I_D, V_C/E_C) = -\tau(I_D, E_C/V_C)$$

a result that will not usually hold for the product moment correlation.

Finally, the exact distribution of the product moment correlation coefficient is known only when X and Y are normally distributed whereas the distribution of τ is approximately normally distributed for small sample sizes independently of the distribution of X and Y. Thus the rough test that τ is significantly different from zero at the 5% level if $|\tau|$ is greater than two standard deviations is a good guide, but a similar rough test does not hold for the product moment correlation coefficient. The standard deviation of τ depends only on the sample size and the number of ties (see Kendall, 1962, p.55).

Daniel, W.W., 1978. Applied Nonparametric Statistics. Houghton Mifflin, Boston, 510 pp.

Darroch, J.N. and Ratcliff, D., 1978. No association of proportions, J. Int. Assoc. Math. Geol., 10: 361-368.

Kendall, M.G, 1962, Rank Correlation Methods. Griffin, London, 199pp.

APPENDIX 6.

Mokari No.1 Well Descriptions of the dispersed organic matter.

L.N. 46899 6076 feet 1852.0 metres

Black shale

Transmitted light: Organic matter forms about 50% of the rock, except for interspersed lenses of a few hundred microns which contain no organic material. Much of the organic matter is opaque and appears to be wrapped more or less continuously around the inorganic grains. A few transparent bodies, probably spores and perhaps algae, occur.

Fluorescence mode: Of the exinite material present (which fluoresces yellow) microspores are the most abundant with some algae and cuticle present. The algae fluoresce a much brighter yellow than the spores. The amount of exinite is about 5% of the rock.

L.N. 48698 6087.8 feet 1855.6 metres

Sandy siltstone

Transmitted light: The organic matter occurs in coarse macroscopically visible fragments, forming about 5% of the rock. The fragments are predominantly opaque, and the transparent ones appear to be of a vitrinite type.

Fluorescence mode: Exinite material is extremely rare and occurs as micrspores and some cuticle.

L.N. 48697 6087.9 feet 1855.6

Carbonaceous siltstone

Transmitted light: Organic matter forms about 10% of the rock. It is mostly fairly coarse as macroscopically visible fragments, both opaque and transparent. The transparent material appears to be of a vitrinite type.

Fluorescence mode: Exinite material occurs only rarely and then only in the fine grained portions of the rock, as micrspores and cuticle.

L.N. 48696 6555 feet 1998.0 metres

Black silty shale

Transmitted light: Organic matter makes up about 10% of the rock. It occurs predominantly as very fine stringers, a few microns wide and 100 - 200 microns long. These stringers are both opaque and transparent: the transparent material may be of both vitrinite and exinite types.

Fluorescence mode: Abundant exinite material is present, probably forming 2-3% of the rock, and consisting mainly of microspores, but also some algae and cuticles. At the appropriate degree of maturity, this should be a good source rock for both liquid and gaseous hydrocarbons.

Purni No.1 Well

L.N. 48702 5092 feet 1552.0 metres

Carbonaceous siltstone/sandstone contact

Transmitted light: Organic matter forms about 10% of the rock, overall, occurring in fine fragments to macroscopically visible bands. The most common size is 50 - 200 . Virtually all of the material is opaque, except in rare lenses.

Fluorescence mode: In the coarse grained portion of the rock there are only extremely rare microspores. In the fine grained lenses exinite material is abundant mainly as microspores, but also algae and cuticle, forming about 10% of the lens. In this particular sample there is very little fine grained material.

L.N. 48701 5255 feet 1601.7 metres

Black carbonaceous shale

Transmitted light: Organic matter forms about 40% of the rock and occurs as fragments from 5 microns to hundreds of microns. Most of the material is transparent, and appears to be of a vitrinite type.

Fluorescence mode: By fluorescent light abundant exinite material is present, in the form of microspores, cuticle and rarely algae. The algae and some of the cuticle fluoresce a much brighter yellow than do the spores. There is about 5 - 10% exinite material. This should be a good source rock for liquid and gaseous hydrocarbons.

L.N. 48700 5280-81 feet 1609.3-9-6 metres

Pale grey laminated siltstone

Transmitted light: Most of the rock is very fine grained with correspondingly fine fragments of organic matter (5-10 microns), which form about 2% of the rock. These fragments are virtually all opaque. In the coarser lenses the carbonaceous material is also coarser, 20 - 50 microns fragments and some long stringers. Rare lenses contain some transparent fragments and spores.

Fluorescence mode: Microspores are present, but generally sparse, 1%, except for small lenses where they are a little more abundant. There are very rare bodies of possibly algae or resin, and some coarser material which may be cuticle. The overall exinite content is 1%.